SCIENTIFIC AMERICAN

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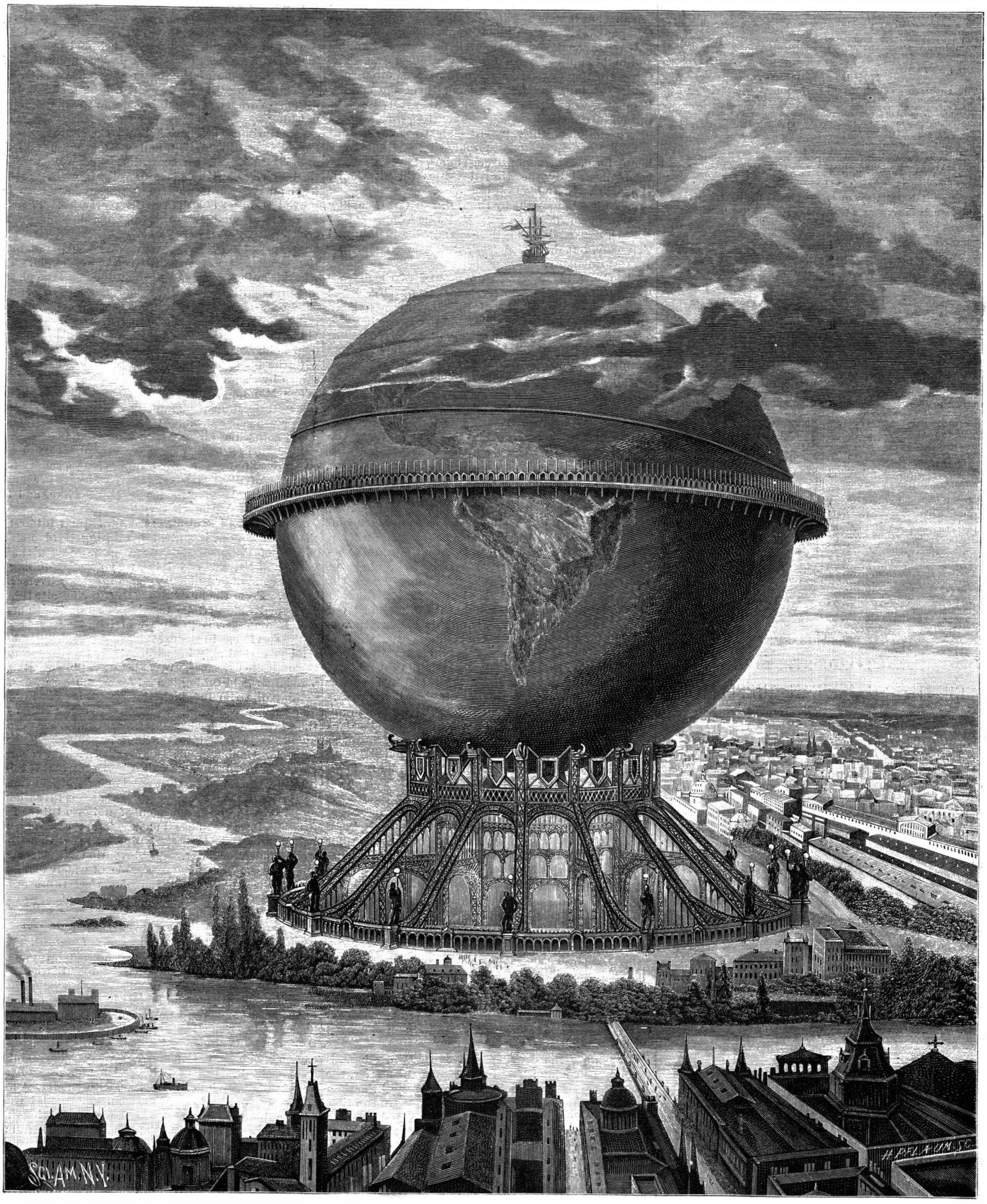

M. PALACIO'S DESIGN FOR A COLOSSAL MONUMENT IN MEMORY OF CHRISTOPHER COLUMBUS.—[See page 260.]

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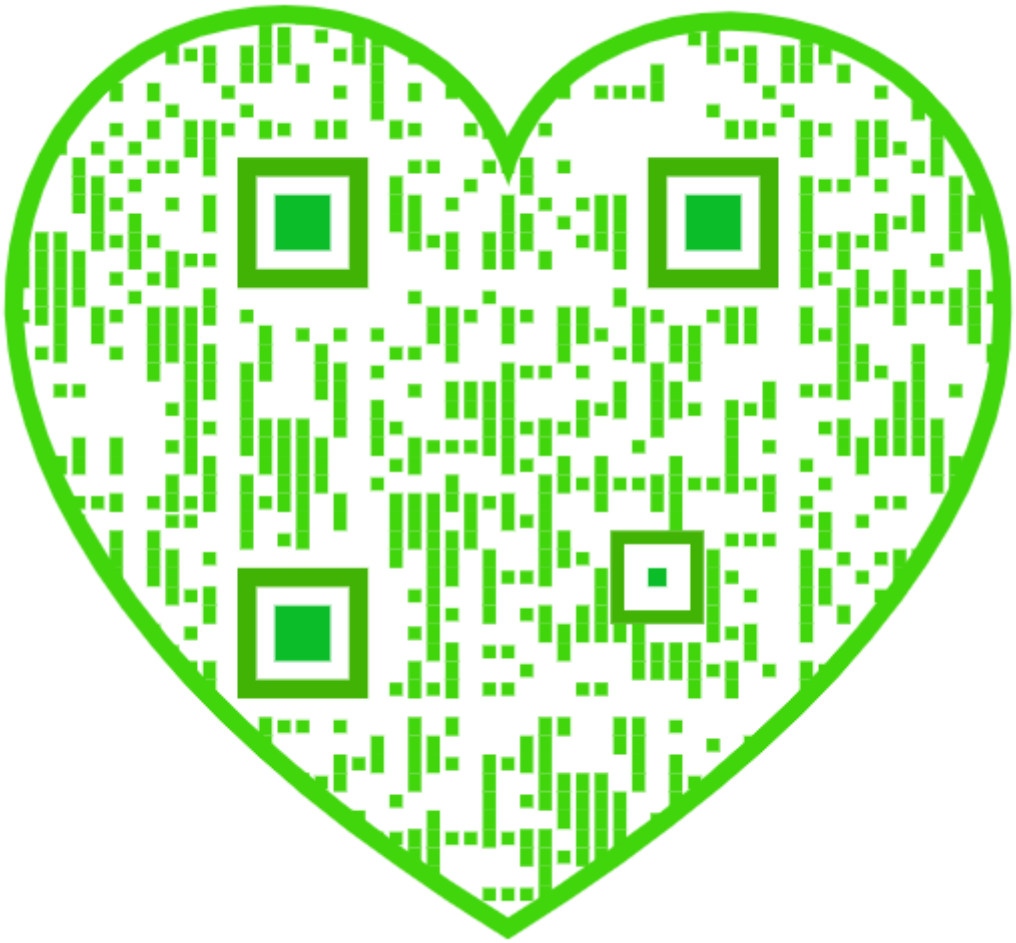

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THE VESTIBULED CAR PATENT DECISION.

Twenty or thirty years ago the passenger cars of the Housatonic Railway, running northerly from Bridgeport, Conn., were equipped with flexible hoods, covering and inclosing the ends of the cars. In the sides of the hoods were entrance doors. When the hoods were in use and the ordinary end doors of the cars thrown open, the train formed as it were one long, continuous car, forming, in fact, what is now known as a vestibuled train. These vestibuled vehicles of the Housatonic road were specially advantageous for the summer ventilation of the cars. Air tunnels were extended from the front of the locomotive to the first of the hooded cars, into which poured a mass of pure air, free from dust and cinders; the fresh air passed through the entire train, being discharged from the rear car. These vestibuled cars were used for several years with much satisfaction to the public, but somehow or other they were finally given up and remained as it were a lost art until the Pullman Car Company revived them, added improvements, obtained patents thereon, and introduced the now well known and highly appreciated Pullman vestibuled cars. The success of these palatial structures induced other companies to adopt the hoods, among them the Wagner Company, whereupon the Pullman Company brought suit for infringement, asking the court for such a broad interpretation of their patent claims as should shut out all other car companies from using vestibuled cars in any form. These monstrous claims, it appears, have been allowed by the United States Circuit Court, Massachusetts, Judge Colt presiding.

The suit was brought by the Pullman Car Company for infringement of George M. Pullman's patent of May 14, 1889, against the Boston and Albany Railroad Company, but the real defendent is the Wagner Palace Car Company.

The Court, in answer to the ground of the defense that the patent is void for want of novelty, says: "Considering the amount of thought in the country directed toward improvements in railway mechanism, whereby greater safety and comfort may be secured to the traveling public, it hardly seems possible that the Pullman vestibule system, in view of what it has accomplished, and the immediate recognition of its merits, was the result of the exercise merely of mechanical skill, and therefore not patentable under the laws of the United States. Leaving out the Sessions patent, I can discover nothing in the prior state of the art which anticipates the Pullman patent, or which should render it void for want of patentable novelty."

The Court then took up the Sessions patent, which was a patent granted to H. H. Sessions on November 15, 1887, and which, it is contended by the defendants, describes what is now claimed as the Pullman invention. Sessions is general manager of the Pullman Company, and he applied for his patent two weeks before the Pullman application was made. Judge Colt said that the fact that these applications were filed at about the same time goes to show that Sessions thought he had invented something and that Pullman believed he had invented something; and his honor, after examining in detail the claims of the two patents, said:

"The problem Sessions set out to solve was to diminish certain evils incident to a train of cars, namely, to the starting and stopping of them, and to a swaying which arises under certain conditions when the cars are moving. On the other hand, what Pullman undertook to do was to overcome the difficulties incident to a vestibule connection between cars, and he accomplished this by means of 'flexible or adjustable joints to permit a sufficient movement between individual passenger cars,' which he declares is the invention he desires to protect. I cannot, upon a comparison of the two patents, taken in connection with the evidence of Sessions, hold him to be the prior inventor. It seems to me that it would be an act of injustice for the Court by inference to incorporate the Pullman invention into the Sessions patent, and thus prevent both inventors from deriving any benefit from this improvement, because it is manifest that if we destroy the Pullman patent, Sessions can derive no benefit from the Pullman invention, because he nowhere describes or claims it in his patent."

The Court, in conclusion, said, "Upon the construction now given by the Court to the Pullman patent I have no doubt that the structure used by the defendants is within the patent. It may not work perfectly, but it contains the substance of the Pullman invention. Let a decree be drawn for complainant as prayed for in the bill."

Concerning the decision in his favor Mr. Pullman is reported as saying: "As I understand the matter, the decision covers every point involved in the litigation, and is a complete victory for us. It will mean that no other company can lawfully use a vestibule."

"The decision completely knocks out the Wagner Car Company," said the general counselor. "They will not be able to use any sort of a vestibule."

The public will be at a loss to understand how it is that an invention which was in practical use years ago can now be revived by another inventor, and new patent claims granted to him so broad in scope as to shut out everybody else. In the majority of such cases, especially when the parties are ordinary private individuals, the courts generally take care to limit the interpretation of new claims to the precise improvements set forth, which is as it should be. But when the plaintiffs are rich and powerful, like the Pullman Company, or the Bell Telephone Company, then our courts are apt to blunder, and wield their judicial power to strengthen and support these grasping and gigantic monopolies. Evidently this is not as it should be.

INTERESTING EXHIBITS AT THE AMERICAN INSTITUTE FAIR.

The 59th annual exhibition of the American Institute opened, in this city, on October 1, and is now in progress. It is to continue until November 29. In most respects it is in full operation, and the floor space is well filled with interesting exhibits.

Woodworking machinery and products are well represented. The Pyrogravure Decorative Wood Co. shows some exceedingly pretty panels and other parts in different woods. These have designs upon them in full relief. Some of the designs are quite ornate, and the exhibit suggests very excellent ideas for home decoration. Various other exhibits are in the line of house finishing.

The Burlington Venetian Blind Co. show their sliding blinds, Hill's patent, and mosquito nets and Venetian blinds. The latter, with slats connected to vertical tapes, take the place of roller shades. Copied from an old European structure, they have been improved to accord with American practice. The well known Norton door spring and check is shown, together with the Prescott trackless sliding door. This door works by a very ingenious species of parallel motion, so that it is suspended from a single pin. The whole is adjusted in place without touching the plaster of the partition which the door enters. It cannot, of course, run off to one side, as there is no track nor rollers. A very simple wedging arrangement is provided, which fixes the door laterally. The Barnard door holder, a very simple substitute for striking pin, with the added function of keeping the door open, is shown by the same agent.

The Monumental Bronze Co., of Bridgeport, show their white bronze monuments, with their slightly roughened surface, almost resembling stone. Their manufacture has already been described in these columns. In fine iron casting, T. Shriver & Co., of this city, have an interesting exhibit. Their specialty is in the line of dies for silverware, jewelry, paper hangings, cane and umbrella heads, and the like, and the quality of the castings is very fine.

Another small exhibit, yet one of great interest to the metal worker, is that of the Spring Garden Metal Works, of Philadelphia. By a secret process, the invention of Mr. Ellwood Ivins, they produce tubing of all sizes and of great lengths from the most diverse materials. From the finest Stubs steel the minute tubing for hypodermic syringe needles, one hundredth of an inch in diameter, is produced in long lengths. Some of the specimens in the exhibit were coiled up and resembled exceedingly fine wire. Gold and aluminum, as the opposite extremes, are made into tubing of all sizes. The larger gold tubing is used for watch case work, in making the rim in which the crystal is set. From a long tube successive slices or rings are cut, which, from their great accuracy in respect to thickness, are worked by means of dies into the best possible rims. Stem tubes for watches are also made, with such unerring accuracy as to thickness of walls that the fitting is perfect from the start, and no time or labor is required to make corrections. The inventor states that his invention is applicable to the production of uniform tubes of all sizes and forms, and of all metals, from the size of a fine hair up to a three foot water pipe, and that there is no weld, solder, or joint. The invention is evidently a most remarkable one, and capable of widely extended uses. The ready production of perfect tubes out of such difficult working metal as aluminum is one of the peculiarities of the process.

In the production of heat the United States Fuel Company shows various applications of sestalit, a fuel that is burned in portable heaters for general domestic uses. It needs no chimney or special ventilation, and the stoves in which it is consumed have no smoke pipes. A rival to gas or charcoal for heating purposes is shown in the Stickney kerosene oil burner and plant for heating soldering irons. The oil is fed through a jet, and is burned by the agency of a blast of air. In gas stoves, the American Meter Company, of this city, has an interesting exhibit. One of their open heaters has a backing of peculiarly indented bricks, with small cast iron gratings or fingers in front of them. The gas is burned with a blue or non-luminous flame, and brings the iron fingers and the surface of the fire brick to full incandescence, so as to produce the effect of a strong anthracite coal fire. Their well known cooking stoves and luminous flame open heater are also shown.

The artificial production of cold is illustrated by the exhibits of L. Dermigny & Co. The exhibitor supplies a freezing apparatus for the production of ice and ice

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cream by the solution of salts. A special refrigerating salt is supplied to be recovered after use by evaporation. The ice produced is illustrated by models made of paraffine wax, which have a very natural appearance. Naphtha, gas, and steam engines are shown in considerable variety. The Gas Engine and Power Company, of this city, have a number of their familiar naphtha launches on the floor. These have proved so convenient that the same company are now making a naphtha engine pump, constructed on the general lines of the launch engine, to be used for general pumping purposes. These engines can be run without any license, and require no special skill or training on the part of the one in charge.

Among gas engines proper the Rollaston, White & Middleton, Hartig, Koerting, Otto, and Crown Compression engines are shown. A novelty in some points is presented by the Cycle gas engine. By a very peculiar combination of levers the four phases of work are repeated once for each revolution of the shaft. This includes the impulse, exhaust, suction, and compression. This feature insures great regularity of rotation. To vary the power the proportions of the mixture are changed. Under all circumstances each single revolution of the shaft includes the impulse and other phases.

The Electro-Metallizing Company, of this city, had some very interesing examples of electro-plating of natural flowers and leaves. By plating upon these with silver or copper very beautiful objects for decoration of lamps or vases are produced. Roses, carnations, ears of grain, and natural leaves are among the objects. To get rid of the leaf or flower forming the core, it is burned out, and if desired, lead or an alloy is poured into the hollow metal. Another electric exhibit is the Mason primary battery for supplying lamps and motors. The inventor's patent battery zinc and his exciting fluid constitute the characteristic features of this battery.

Some interesting food products are shown. Maillard's chocolate is displayed in good style. A statue of the Venus of Milo, made of chocolate, is a prominent object. It was shown at the Paris exhibition. It is seven feet high and weighs 1,985 pounds, containing enough material to make 30,800 cups of chocolate.

Armour's extract of beef, as put up at the well known Chicago factory, is on exhibit. This distinctively American product is produced in large quantities and has been used by the United States Army Medical Department, which is a good certificate of its quality. Another article adapted for the housekeeper is C. C. Parson's household ammonia. This well known fluid is now supplemented by the zommonia of the same inventor, which contains not only ammonia, but soap, so as to have a double claim to cleansing properties.

Among the photographic novelties is the slot machine for taking photographs. On sitting in position and dropping "a nickel in the slot" and executing some manipulations, a photograph of the sitter is passed out. Many other slot machines for weighing, etc., are shown. A number of phonographs are exhibited which work upon the same principle, giving a great choice of airs, songs, etc., to be listened to on the deposit of a five cent piece.

Rancidity of Fats.

The determining cause of the rancidity of fats has been a fertile source of conjecture, and water, air, albuminous matter, ferments and light have by different writers been credited with the sole or joint authorship of the mischief. Some fresh experiments, reported by Herr Ritsert (*Pharm. Zeit*), seem to throw additional light upon the subject. The first experiments had for their object to determine the relation of micro-organisms to the rancification of fats and to ascertain under what conditions sterilized fat becomes rancid. It was found that, notwithstanding the occurrence of most diverse micro-organisms in rancid fat, both aerobic and anaerobic germs die when added to fresh undecomposed fat, from which it was inferred that the change is not initiated by them. Indeed, it was also found that under the influence of sunlight, which killed the germs, the rancidity was produced more rapidly. Experiments were, therefore, made with sterilized lard (1) protected from access of air, but exposed to sunlight, diffused light, and kept in the dark; (2) with access of air, exposed to sunlight and kept in the dark; (3) in atmospheres of moist and dry oxygen, carbonic acid, nitrogen, and hydrogen. As a general result it may be stated that the condition favorable to the production of rancidity proved to be the action of light during contact with air, the change being induced more rapidly, the more intense the light. Thus it was found that sterilized lard, either moist or dry, when kept from contact with air in sealed tubes, remained free from rancidity after two months, even though exposed to sunlight and warmth. When Erlenmeyer's flasks were filled with sterilized lard, stoppered with sterilized wadding, and exposed to sunlight, racidity was evident at the end of a week; but if the contents of the flask were sheltered from light by a coating of black varnish, the lard remained sweet after two months, even when the flasks were only partly filled. In order to ascertain to which constituent of the atmosphere the change is due, the quantity of oxygen, nitrogen, hydrogen, and carbonic acid absorbed by sterilized lard under similar conditions was noted, and the effect produced upon the fat. Oxygen, both dry and moist, was absorbed freely in the light, the fat becoming strongly rancid in one month; but none was absorbed in the dark, the fat remaining quite fresh. Nitrogen and hydrogen both remained unabsorbed, whether exposed to the light or kept in the dark, and the lard did not become rancid. Carbonic acid, dry and moist, was absorbed in the light and to a less extent in the dark, but the lard only acquired a tallow-like taste and no odor.—*Pharm. Jour.*

Koch's Remarks upon his Probable Cure for Tuberculosis.

"I have proved the following substances to be remedies which hinder the growth of tubercle bacilli in tube cultures (to mention only the most important): A number of ethereal oils; among the aromatic compounds, β naphthylamin, paratoluidin xylidin; some of the so-called tar dyes, namely, fuchsin, gentian, violet, methyl blue, chinolin yellow, aniline yellow, auramin; among the metals, mercury in the form of vapor, silver and gold compounds. The compounds of cyanogen and gold were especially conspicuous, their effect surpassing that of all other substances; even in a dilution of one to two millions they checked the growth of tubercle bacilli. All these substances, however, remained absolutely without effect if tried on tuberculous animals. In spite of this failure I have not allowed myself to be discouraged from prosecuting the search for growth-hindering remedies, and I have at last hit upon a substance which has the power of preventing the growth of tubercle bacilli, not only in a test tube, but in the body of an animal. All experiments in tuberculosis are, as every one who has had any experience of them has sufficiently discovered, of very long duration; my researches on this substance, therefore, although they have already occupied me for nearly a year, are not yet completed, and I can only say this much about them, that guinea pigs, which, as is well known, are extraordinarily susceptible to tuberculosis, if exposed to the influence of this substance, cease to react to the inoculation of tuberculous virus, and that in guinea pigs suffering from general tuberculosis, even to a high degree, the morbid process can be brought completely to a standstill, without the body being in any way injuriously affected. From these researches I, in the meantime, do not draw any further conclusions than that the possibility of rendering pathogenic bacteria in the living body harmless without injury to the latter, which has hitherto been justly doubted, has been thereby established."

Progress of the Gas Engine.

A Manchester contemporary says Messrs. Crossley Bros., of Openshaw, the well known gas engine makers, have made a new development in the manufacture of large gas engines. This is in the form of the completion of a new 30 horse power single cylinder "Otto" gas engine, possessing a capability of working up to 100 horse power. All the latest improvements are included in the engine, which is erected on the horizontal plan, and is intended for the Wandsworth Projectile Company, of London. This engine is, however, by no means the largest manufactured by Messrs. Crossley. The double cylinder "Ottos" are now well known among manufacturers and others for possessing many advantages over the ordinary steam engine. Engines of this character are made capable of running up to from 100 to 200 horse power. The firm has now in hand several large installations, requiring from 100 to 500 horse power in each case. One of the latter installations will consist of several double cylinder engines, and will be used for driving the machinery of a large flannel manufactory. The use of gas engines for this work is a new departure; for it has hitherto been supposed that these engines were not powerful enough for driving machinery on a large scale. The order will be the largest that has ever been placed for engines of this description. With the engines laid down by Messrs. Crossley Bros. is connected the Dowson patent economic gas system, which, in conjunction with the engine, brings down the fuel consumption to less than 1½ lb. per indicated horse power per hour. This result has perhaps elsewhere never been arrived at, even by the best and most modern Lancashire mill engines. The machinery in Messrs. Crossley's works has for several years past been entirely driven on this system; and the actual cost of working has never exceeded the above figures. Extensive use of the engines is also made at the works of Sir William Armstrong, limited, at Elswick. There are about 1,000 engines made by the firm at present working in Manchester; and Messrs. Crossley not unfairly assert that as a result they have practically aided in the important work of improving the state of the atmosphere of the district. With the production of the latest single cylinder engine, the firm are now able to provide some twenty-five varieties of engines.

Fun among Editors.

An amusing, if not instructive, triangular contest is now on between the *Engineer*, of London, and the *Railroad Gazette* and the *Engineering News*, of this country. An effort is being made by those distinguished journals to determine whether or no an American locomotive is better than an English locomotive. The argument as far as yet carried on appears to merit the dubious compliment which was paid to Aunt Sally's vinegar pie, "Very good what there is of it, and plenty of it such as it is." In the last issue of the *Railroad and Engineering Journal*. Brother Forney dishes up the whole discussion to date in the form of a delicious literary salad which, as the back of a dining menu would say, fairly tempts the palate with its piquant variety, and satisfies the robust appetite with its wholesome abundance. Forney predicts that when the *Engineering News* buckles right down to the contest and opens its guns in good earnest, the *Engineer* will wish it was never born, and that then, too, "the American locomotive will distend its nostrils, and declare itself victorious with a shriek which will be heard from Alaska to Patagonia, and which will penetrate either diametrically through the earth, or be wafted circumferentially around it to our antipodes, who, standing on their heads, may be able to comprehend the significance of the arguments." The inimitable Forney! None but he could have treated this international episode in so graceful and clever a manner. Here is another glint from his polished blade:

The *Engineer* shouts vehemently, "Our locomotives burn less coal than yours do." The *Gazette* answers, "What if they do, we pull more than you can." From across the Atlantic comes the interrogation to us, "What do your locomotives cost for repairs, anyway?" and the *Gazette* answers ruefully, "We don't know, but we intend to know;" and with real Yankee interrogative retaliation asks, "What do yours cost?" and their adversary replies, "We don't know either," and then they proceed to write long arguments based on what they don't know.—*The Railway Master Mechanic.*

A Notable Catalogue.

The new catalogue of the Frick Company, of Waynesboro, Pa., though nominally a circular for the information of customers, is of sufficient scope to be of general interest. The entire subject of ammonia plants for ice refrigerating, a specialty with this firm, is discussed at length. The merits and defects of different systems are considered, and with a very full exposition of the details adopted by the Frick Company and the reasons for their adoption. Some of the points of special interest affect the type of compressor pumps. This is chosen of the single acting type, in order to avoid the strain upon the piston rod stuffing box of resisting high pressure ammoniacal gas. All the heavy compression is done on the rear side of the piston. The subject of clearance is also treated Many attempts at avoiding it have involved the use of oil in the cylinder. The Frick compressor relies on almost absolute contact of metal with metal, and in order to avoid all trouble, makes the outlet valve of equal area with the piston, so that it may be raised from its seat by the actual pushing of the piston itself. Through all the work similar interesting points of general practice are lucidly treated.

The book is very fully illustrated. Some of the more striking views are photogravure reproductions of large cakes of ice. A standard size produced by the Frick apparatus is eight by sixteen feet and fourteen inches thick. The illustrations show such cakes of ice suspended or supported on edge with men standing behind them whose forms are visible through the transparent mass. A point made in favor of this system, and called the plate system (the Smith patent plate system), is that the ice so produced splits much better than the ordinary artificial cake ice.

Deep Mining.

The mine at St. Andre du Poirier, France, yearly produces 300,000 tons of coal. The mine is worked with two shafts, one 2,952 feet deep and the other 3,083 feet. The latter shaft is now being deepened, and will soon touch the 4,000 foot level. A remarkable feature of this deep mine is the comparatively low temperature experienced, which seldom rises above 75° Fahr. In the gold and silver mines of the Pacific coast, at a depth of less than half that of the French coal mine, much difficulty is often experienced in keeping the temperature low enough to admit of working. In some levels of the Comstock lode the temperature rises as high as 120° Fahr.

The Value of Exercise.

In order to secure a long life and a green old age, somebody has said, and no one will dispute, bodily vigor should be sustained by regular, systematic exercise, avoiding all sudden strain and prolonged exertion as much as possible. Especially is this true of running, lifting, climbing, etc. And labor, while desirable in moderation, should never be prolonged till it produces exhaustion.

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The Electrical Production of Caustic Soda.

The principal chemicals used by paper manufacturers are caustic soda and chloride of lime, or bleaching powder, and these two substances constitute items of considerable expense in paper mills. For some time past it has been hoped that these two chemicals would be obtained directly and economically from common salt by the aid of electricity. Many attempts have been made in the past to effect this object, but we believe they have all ended in failure. This has probably been due to one or the other of two causes—namely, either a deficient knowledge of the laws regulating electric currents or badly constructed tanks and apparatus for effecting the decomposition economically. The practice has been to separate the products of electrolysis by porous plates or diaphragms, which offer considerable resistance to the passage of electricity and add to the general cost of useful work done, and are in other respects objectionable. At length, however, it would appear that caustic soda and bleaching powder can be, and indeed are being, practically and economically produced from common salt by the aid of an electric current. This desirable end has been attained by Mr. James C. Richardson, of London, whose process has been in operation on a working scale for several months past at one of the largest paper mills in the kingdom. The whole apparatus is automatic, the salt solution passing regularly and the caustic soda being drawn off at any strength up to 10 or 12 per cent pure caustic soda. The chlorine, which can also be used direct for bleaching, is absorbed by slaked lime, and bleaching powder is thus produced. We are not at present at liberty to give any details respecting this process, but we may mention that it is not simply a method of producing a bleaching solution by electrolyzing salt, but a commercial process of producing these two important chemicals. The porous partitions are altogether dispensed with in Mr. Richardson's apparatus, and in other respects it differs materially from that employed in previous attempts to effect the same object. It is stated that the cost, both electrically and commercially, is much below that of the ordinary Leblanc process of alkali manufacture, and that at least three times the amount of chlorine is available from each ton of salt decomposed as against that process. Thus a larger quantity of bleaching powder is produced and the purity of the caustic soda ranges very high. The erection of enlarged plant is being proceeded with at the works where it is already in operation, and the adoption of plant is contemplated at the works of a few other leading paper manufacturers.

STEAM DIGGING.

"Steam digging" is the recognized expression for the art of forking land by steam power for the purpose of tillage, and its adoption has of late years been steadily increasing. According to the most modern practice, it is performed with an ordinary traction engine of which the digging apparatus forms a part. We illustrate Mr. F. Proctor's digging device, which is

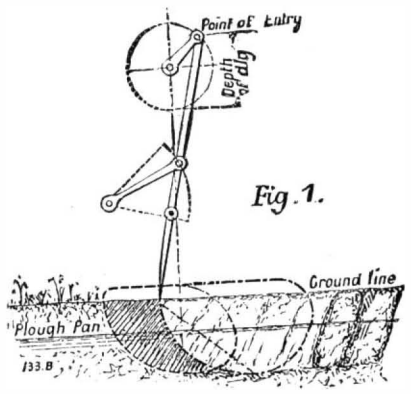


Fig. 1.

manufactured by Messrs. Burrell & Sons, Thetford, and for which many advantages are claimed by its author. The device consists of: Three steel forks and fork handles, three-rocking levers, one wayshaft, and a three-throw crankshaft with its necessary bearings. Each fork is made up of steel tines, which are held firmly in a grooved clamp about 3 ft. in length and which is attached to the fork handle by a spring hinge somewhat similar to that which is used on the fork of a hay tedder. The crankshaft is fixed where the water tank of an ordinary traction engine is usually fitted.

The illustration, Fig. 1, shows the path which is traveled by the extremity of a fork tine of medium length, when the machine is stationary and when it is in motion, and also a section of the spit of earth which is sliced off and thrown back at each revolution of the crank shaft. The reciprocating action of the forks is governed by the rocking action of the under lever, but the action of this again is modified by the traveling motion of the machine itself, for it will be seen by the illustration that the slope at which the forks enter the ground when the machine is traveling is more upright than when it is stationary. The inclined nearly straight line shows the path of the fork when the engine is stationary, and the steeper curved line when the engine is moving. The cross hatching indicates the shape of the spit of earth turned off at each stroke. The width of this spit of earth is about 7 in., and the speed is regulated to turn over an average of 72 spits per minute.

In constructing a steam digger the greatest care should be taken to get the centers of the crank and way shafts in the correct relative position with each other. Machine proprietors have sometimes been tempted to alter their traction engines into steam diggers, but Mr. Proctor states that owing to the shaft centers being unsuitably arranged the work has proved unsatisfactory. Three methods are adopted for "taking a field:"

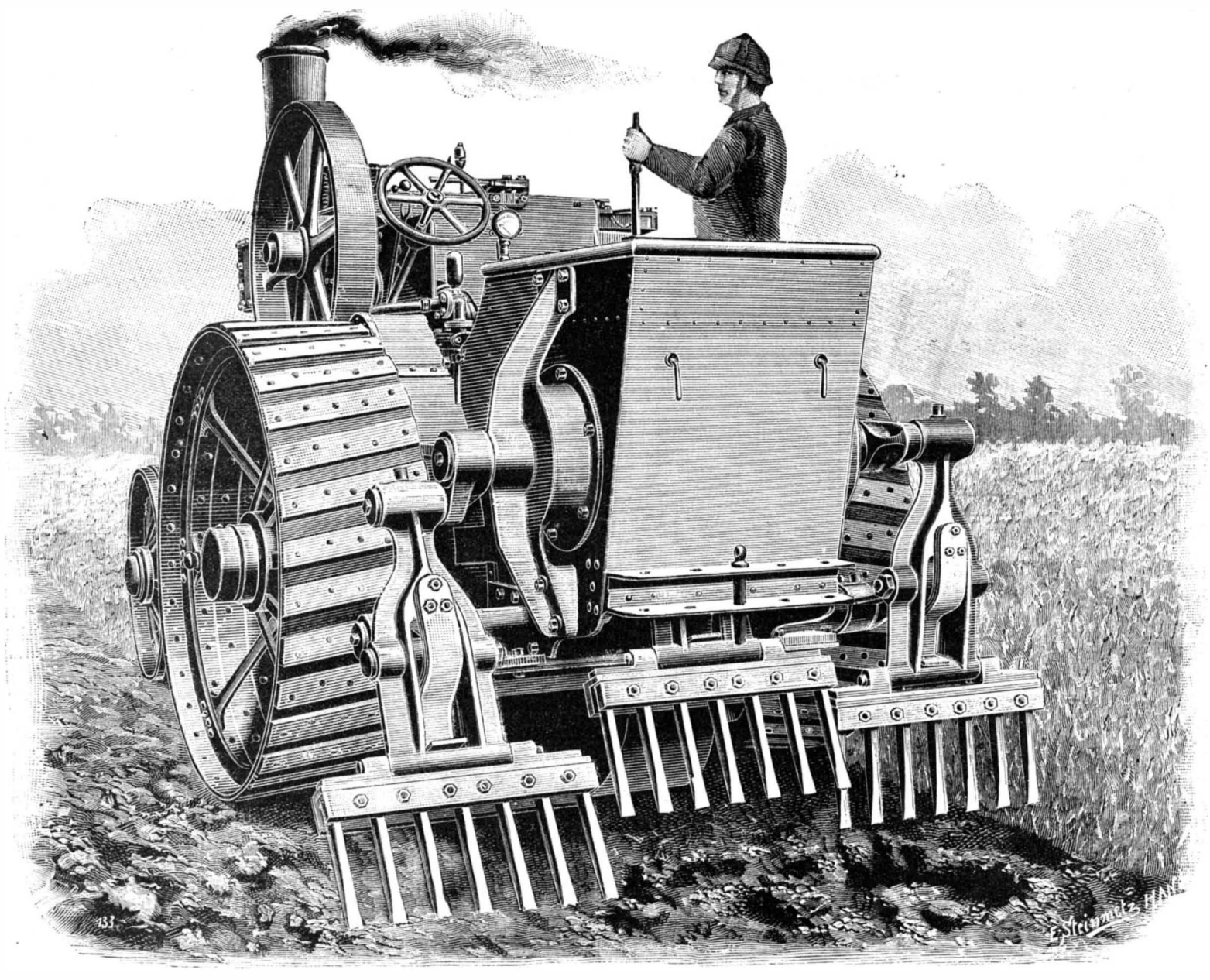
1. The machine travels round the outsides and then works inward similar to the path usually taken with the sheaf-binding harvesters.

2. Another plan is to start in the center of the field and describe with the machine a number of circularly ended rectangles till the whole field has been gone over.

3. In this case a straight up and down course is taken, and the machine is brought into the straight again by reversing the engine, much as is done with steam engines in reversing them by tria..gles. The time occupied in thus turning takes scarcely longer than that of an ordinary horse plow at the headlands, and it is the method which is most generally adopted.—*Engineering.*

Passiflora Edulis.

A luscious fruit is that of Passiflora edulis (the Brazilian passion flower), which is much grown at Tan-y-bwlch Hall, North Wales. We have never seen, says *The Garden*, a finer mass of it than here, one house being devoted to it, and plants also permitted to cover the back wall of a large vinery with their free growth and flower. This Passiflora, apart from its value as an edible fruit, is very pretty when in bloom, and also when bearing freely its plum-shaped fruits. It has been fruiting freely since last June. The fruits are like very large egg plums, deep maroon in color, but varying in tone according to their several degrees of ripeness, and with a very tough and thick skin. The pulp inside is yellowish and not very pleasant to the eye, but the flavor is brisk, agreeably acid, something between a melon and a pear. It is used largely for dessert here, and preferred before fruits regarded generally as more luscious. Mr. Roberts, the gardener, has little difficulty with it, fruiting it freely on vinery walls, and yet the growth does not interfere with the vines planted in front. Here is a fruit which ought to be introduced in the United States. Perhaps the agricultural department will try it.



IMPROVED STEAM DIGGER.

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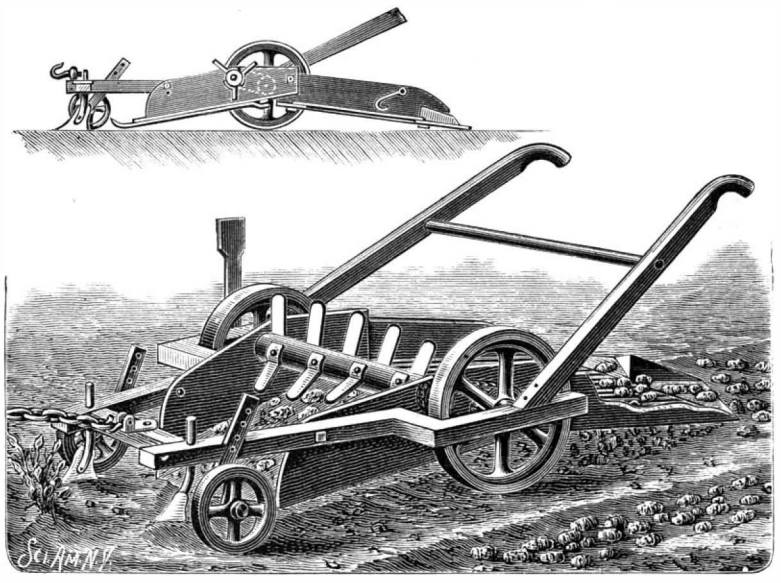
A NEW POTATO DIGGER.

An apparatus for digging potatoes from the soil and delivering the same in rows upon the ground, the tubers being cleaned by it from all adhering soil, is the subject of the invention shown in the illustration accompanying this article. It has been patented by the inventor, Mr. James Gohm, of Newport, R. I.

A frame consisting of side bars and cross bar in front is carried by four wheels. Two wheels in front are carried by adjustable bars so that the forward end of the frame can be raised or lowered at will. Toward the rear the frame is supported by the cross axle of the rear wheels. This axle is dropped low down between the wheels. A pair of small plows or cultivator blades are carried by the forward corners of the frame. Within the frame and carried by the dropped portion of the main axle is a scoop. In front the scoop is provided with a cutting edge and central plow point. At its rear end its floor consists of bars spaced so as to form a screen, and at the rear of the screen a central deflector is placed. Across the center of the scoop a drum carrying a series of blades extends, which is caused to rotate by chain and sprocket wheel connection with one or both of the main wheels. A pair of handles extends from the rear, while a chain and clevis or drawbar is provided in front for the draught animal. In operation the apparatus is drawn down the row of potatoes. The cultivator blades throw to each side surplus soil and weeds. The central hillock thus formed is entered by the point of the scoop. Earth and potatoes are forced backward over the floor of the scoop, their passage being aided by the revolving blades. As the screen is reached the earth sifts through and the potatoes roll rearward. As they meet the deflector they separate into two streams and are deposited on the ground in a double row. Thus a clear space is left for the attendant to walk upon. The scoop is jointed in the middle transversely. The front end can be depressed and adjusted by side bolts which pass through its sides and through the frame. The rear portion in operation rests upon the ground. Hooks are provided by which it can be sustained above the ground if desired.



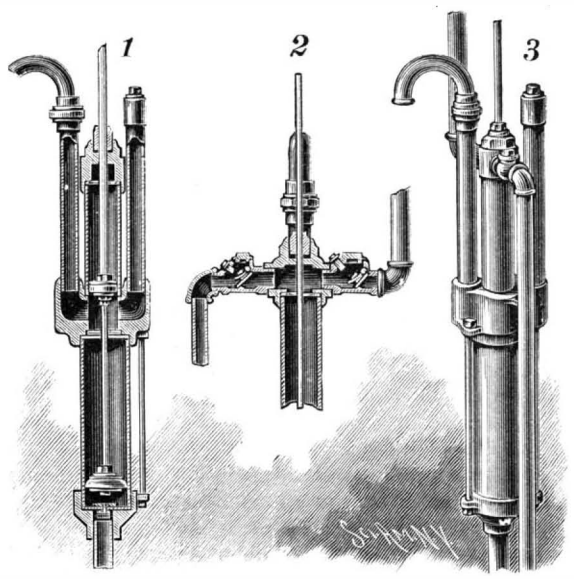
GOHM'S POTATO DIGGER.

Dion Boucicault, the Wonderful Dramatist.

The obituary notices of the late Dion Boucicault attempt to give approximate estimates of the enormous extent of this wonderful man's work, and to show that the history of the drama includes no more remarkably industrious personage. Since his death recently we have seen it estimated that $40,000,000 has been spent in the last twenty-five years by the public to see his plays; that a single play, the "Colleen Bawn," brought him $1,000,000, and another, the "Shaughraun," $400,000, and that thirty-five dramas, out of his total of over 400, ran for at least 150 nights each at their first production and have been each played over 5,000 times altogether. These performances have done a surprisingly great work for the English-speaking drama as a whole, in that they have made the fortunes of scores of theatrical managers, founded theaters enough to fill a city, and cultivated a theater-going taste in the public of America which no figures can adequately define either in extent or in the time for which Boucicault's influence will last. Such a record is gigantic, colossal. We are most of us, naturally, under these circumstances, accustomed to think of Dion Boucicault as a playwright. But his quickness of mind, his tireless energy and industry, his genius for combining distinct elements into a newly created whole with an individuality of its own, and his unsurpassed intuition as to what would please and entertain the great masses of his fellow citizens, made him a successful actor as well as playwright, and his own interpretations of character on the stage had an inestimable share in the triumphs that filled his astonishing career. It is altogether doubtful if he left room in this age of the world for another like him.—*New York Press.*

A NEW AERATING AND WATER PUMP.

The expediency of aerating water, and the efficiency of aeration in destroying noxious organic matter which the water may contain, has long been recognized by sanitarians. In the present device a pump is presented which, while doing the work of an ordinary lift and force pump, also aerates the water of the cistern or well in which it is used. Its construction is clearly shown in the cuts. It consists of two single-acting pump barrels and pistons arranged in vertical alignment, one above the other, the piston rods being joined together. Fig. 1 shows this arrangement in section. The lower piston contains a valve opening upward, and a similar valve closes the lower end of the lower cylinder. On the right of the section is seen a closed pipe that acts as air reservoir, on the left is the water discharge pipe. This combination represents the ordinary force pump and works accordingly. The cylinder and piston which surmount it form an air pump. In Fig. 2 the arrangement of the valves and connections of the upper cylinder is shown. The pipe on the right, which extends up to the surface of the ground, with valve opening inward, admits air to the cylinder on the down stroke of the piston. The pipe on the left, with valve opening outward, leads down to the bottom of the well. On the up stroke of the piston, the air from the cylinder above it is expelled through this pipe, bubbling through and aerating the water in the well. The two pump chambers are connected by a chambered union coupling, and in Fig. 3 the method of assembling the parts is illustrated. The device, it will be seen, can be applied to many common kinds of pumps.

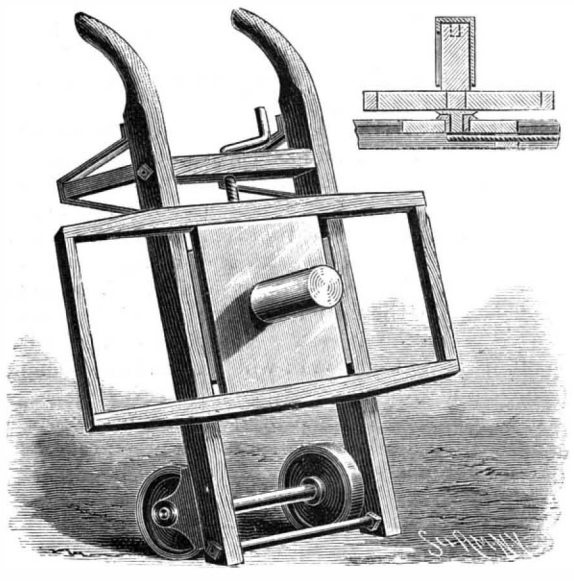


DACUS' AERATING AND WATER PUMP.

This improvement is the invention of Robert H. Dacus, of Dardanelle, Ark., by whom it has been patented.

LYON'S TRUCK.

The handling of belting, rope, lath, yarn, or other flexible goods required to be put up in rolls can be greatly facilitated by the use of the hand truck illustrated in the accompanying illustration. This is the invention of Mr. Samuel Lyon, of 66 South Canal St., Chicago, Ill.

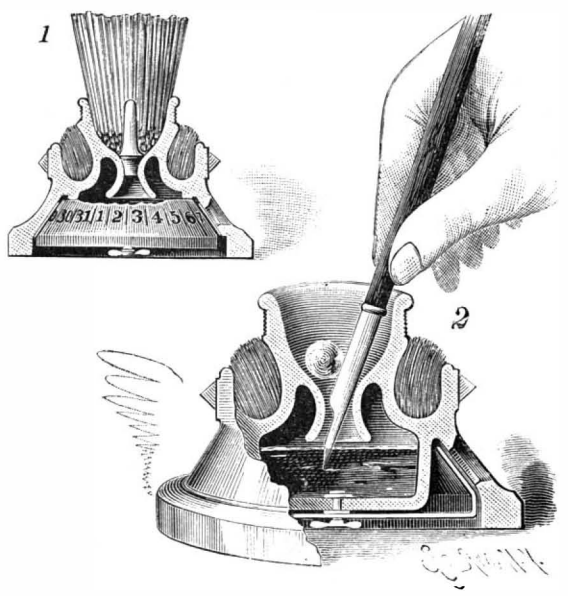


TRUCK FOR RECEIVING BELTING.

A platform is arranged to slide in grooves in the sides of the frame of the truck, and the position of this platform is regulated by a screw-threaded shaft located underneath the same, which may be revolved by means of a crank at one end. A rectangular frame is mounted pivotally upon this platform, and may be revolved in any direction. It bears at its center a drum fixed rigidly thereto. A sleeve having transverse handles and a slot in its side is arranged to fit over this drum. In the general view of the truck the drum is shown without the sleeve, but the detail at the right hand corner shows the location of the sleeve when put in position for winding. The end of the belt or object to be wound is inserted in the aperture or slot in the sleeve, and this is rotated, by means of the handles, until the desired amount of belt has been wound off. The belt can then be wheeled to any part of the building. The belt can be readily cut by means of this device from either end of the roll, and if, for any reason, more has been taken off than is required, it can easily be put back again. The reel can be raised or lowered as desired, and the roll can be readily tightened from the center.

NEW DESK, TOILET AND DISPLAY BOTTLE.

A bottle of peculiar construction, combining the requirements of an inkstand, match safe or perfumery bottle, together with pen wiper, calendar, and other adjuncts, is the subject of the illustration. It has been patented by Mr. Theron H. Palmer, of San Bernardino, Cal. The main portion of the bottle rises from its base in generally conical shape. Within it is a well that may be used for ink or perfume. An annular exterior chamber that surrounds the central aperture may be filled with hair or other brush-forming fiber to act as a pen wiper. The portion immediately above this is roughened to give a surface on which to strike matches. The conical part of the base is transparent and is adapted to have pasted or secured within it any matter for display, such as advertisements, etc. An aperture is left in the base over which no advertising matter is allowed to extend. Within the base a truncated cone of metal or other material is arranged to rotate. It is marked with the days of the month, and one of its designations can be seen through the aperture. This constitutes a calendar. Different forms of stopper can be used. In the cuts a ball valve is shown in use for an inkstand, and for the match safe another form of stopper is provided, as shown in the upper figure of the cut. A third form of stopper, which closes tightly the upper portion of the mouth, is used when the bottle is to contain perfume.



PALMER'S NEW DESK, TOILET AND DISPLAY BOTTLE.

A British Torpedo Boat Picked up at Sea by an American Schooner.

A dispatch from North Sydney, C. B., gives particulars of the arrival there of the American schooner Samuel R. Crane, of Gloucester, Mass., having in tow the British first class torpedo boat No. 62, which was picked up at sea in good condition, but with nobody on board. This torpedo boat was attached to the Newfoundland fishery protection fleet, carried a crew of twenty-one men, and was in tow of her Majesty's ship Pelican when the gale of October 12 broke her away. The Pelican stood by the boat till dark, but in the morning she could not be seen.

No. 62 was one of forty-eight similar vessels that belong to the British fleet of first class torpedo boats, of which there are eighty-six in all. These boats are 125 ft. in length, with from 60 to 66 tons displacement and 750 horse power. Their speed is about twenty-one knots. No. 62 was built by Yarrow & Co., at Poplar, London, in 1886, and was sent to Halifax last summer as an adjunct to the coast defense fleet at that port. Her armament consisted of five torpedo guns, two three-pounder Hotchkiss quick-firing guns, and two two-barreled Nordenfelt guns. She also carried an electric search light.

When picked up, the torpedo boat's holds were battened down. Nothing has been heard of her crew.

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M. PALACIO'S DESIGN FOR A COLOSSAL MONUMENT IN MEMORY OF CHRISTOPHER COLUMBUS.

The construction of the Eiffel tower has awakened the pride of the nations. It is said that North America proposes to construct an iron tower which shall be higher than the one in Paris. England also desires to have a monumental tower.

When North America proposed a competition for the construction of a tower to be erected at the Universal Exposition of 1892, a Spanish architect, a native of Bilboa, Mr. M. Alberto de Palacio, drew an original design, of which we publish an engraving.

Mr. De Palacio has conceived a most perfect form, the sphere, which could not have been used prior to the knowledge of iron as a building material, because only by the modern methods of uniting the various parts, of which this material is susceptible, could a sphere be produced with a diameter of nearly 1,000 feet, that is, equal to the height of the Eiffel tower. This idea symbolizes the geographical completion of the earth which was realized by Christopher Columbus' discovery of the New World.

The following is a description of the magnificent design: The colossal sphere is mounted on a base which is 262 feet high, and is crowned at its North Pole by the caravel which carried Columbus to the New World. The monument is brilliant with the colors of the continents, oceans and islands of the terrestrial sphere.

The sphere will be encircled at the equator by a platform 3 280 feet, or more than half a mile, long. An exterior spiral running around the northern hemisphere will form a track nearly two miles long, leading from the equator to the North Pole. At night the sphere will be illuminated by the lines of light which will form the outlines of the continents and islands, thus casting over the city torrents of refulgent brilliancy. The great pyramids of Egypt, the Sphinx, and the Colossus could lie in the hollow interior like jewels in their case. So much for the exterior aspect.

An interior track runs around the southern hemisphere from the South Pole to the Equator, where it joins the exterior spiral. The total length of the spiral is nearly four miles, over which the sightseer can travel on a tramway.

In the base and under the majestic central rotunda will be placed a gigantic statue of the great discoverer surrounded by the navigators and missionaries who rendered his discovery fruitful. In the semicircle around this Olympus of heroes, inclosing the amphitheater, will be allegorical statues representing all the Spanish nations.

In the remaining spaces of the compartments in the base a large Columbus library will be distributed; auditorium for the cultivation of the natural sciences, museums of zoology, mineralogy, and botany of America, rooms for the Spanish Geographical Society, a great naval museum in the interior central compartment, a meteorological observatory in the hull of the caravel. All this is independent of the promenades, cafes, and restaurants for the public.

In the interior the celestial sphere can be exactly reproduced. It can also be used for magnificent panoramas, because the spherical form is the best for obtaining illusions of perspective. There will be a place for public entertainments.

This astonishing monument can serve as a perennial remembrance of the first Spanish-American and Colonial Exposition.

Mr. Palacio secures the stability of this immense mass by means of a simple method similar to that used for equestrian statues, so that the sphere will be able to resist winds of greater force than a cyclone.

From a business point of view Mr. Palacio makes the following calculation:

One hundred thousand spectators paying an entrance fee of $1, will bring $100,000. This will replace the capital in 62 days, without counting the profits of the cafes, entertainments, etc. The estimated total cost is $6,000,000.

INDISPENSABLE DATA FOR THE ESTIMATE.

Diameter of the sphere	984 ft.
Elevation of the sphere above the ground	262 "
Total height of the monument	1,312 "
Surface of the sphere	337,989 sq. yd.
Volume	18,492,341 " "
Length of the equatorial platform	3,280 ft.
Length of the ascending spiral	19,684 "
Total pressure of the wind of a hurricane against the monument	42,390,000 lbs.

ESTIMATE.

Cost of the sphere and its base	$5,059,200
Cost of the machinery, elevators and other accessories	$1,240,000

The architect, Mr. Palacio, is the designer of the movable bridge at Bilboa, used in connection with the submarine railway of Orton on the coast of Spain.—*La Ilustracion Española y Americana.*

IF a box six feet deep were filled with sea water and allowed to evaporate under the sun, there would be two inches of salt on the bottom. Taking the average depth of the ocean to be three miles, there would be a layer of pure salt 230 ft. thick on the bed of the Atlantic.

Prepared Sea Water for Marine Boilers.

Some interesting practical tests have recently been made at Southampton with an apparatus for the chemical preparation of sea water for marine boilers, suggested by Prof. Vivian B. Lewes, of the Royal Naval College, after many laboratory experiments and analyses of water. So far as the chemistry is concerned, it may be, says *Engineering*, thus briefly described: In order to separate the whole of the calcium and magnesium salts it is only necessary to raise the sea water to the boiling point with a proper quantity of sodic carbonate. This would convert the calcic sulphate into calcic carbonate, sodic sulphate, a soluble salt, being at the same time formed, while calcic carbonate precipitates as a soft powder, there being no calcic sulphate to harden it. The magnesium salts are thrown down as carbonates and a bulky precipitate, which must soon be removed, is thus formed. After this removal only the sodic chloride and sodic sulphate will remain, both so soluble that there will be no fear of anything depositing unless the evaporation were carried to the very improbable density of 1·2. The importance of the subject may be judged from the fact that one ton of water is required per twenty-four hours per 1,000 indicated horse power.

Prof. Lewes having perfected his process as far as was possible on a laboratory scale, Mr. J. H. Biles, the general manager of the naval construction works at Southampton, placed a crane boiler in the works at his disposal in order to try the practical effect of the process upon it, and after steaming continuously for a month with nothing but prepared sea water, the boiler was, on September 18, opened in the presence of a representative gathering of gentlemen interested in the subject, when the interior of the boiler was found to be in perfect order, no trace of incrustation or scale having been formed, the plates merely looking as if they had received the thinnest possible coating of lime white.

The feed water for the boiler was drawn from the river Itchen, a quarter of an hour before high tide each day, and on analysis proved to be practically pure sea water, but contained besides much organic matter, which under ordinary circumstances would have given an excessively deleterious form of deposit. This water having been stored in a large tank, was pumped a ton at a time into what Prof. Lewes terms the "precipitator," an egg-shaped vessel placed on end. Into this water exhaust steam was periodically blown until the boiling point was nearly reached, when a packet of "precipitator powder," already referred to, was added to the water through a small manhole in the top of the vessel. This, at once, threw down all the lime and magnesium salts present in the sea water, in the form of a white flocculent precipitate. The vessel was then closed, and steam blown in until a pressure of 10 lb. was reached, and under these conditions the precipitated constituents of the sea water rapidly settled, leaving the liquid only slightly turbid, and this turbidity was got rid of by running the prepared water through an asbestos filter into the hot well, from whence it was pumped into the boiler. The sea water so treated contained nothing but sodium salts, which, like common salt, are very soluble, and will not deposit until evaporated to a density of 1·2, a point never approached except by the grossest carelessness, being equal to over 7-32 on the salinometer.

The advantages claimed for the use of this prepared water are that, containing no lime salts, all incrustation is avoided, and the expense and wear to the boiler of scaling is done away with, while the removal of the magnesium salts present in the original sea water prevents the pitting and corrosion of the plates. Zinc protectors are rendered unnecessary, and no distilling boiler for water for make-up has to be carried. As regards expense, it is claimed to compare favorably with all other processes, being about one-fourth that of distilled water, and less even than the ordinary fresh water supplied at many ports.

The density of the prepared water is less than the density of salt water, and as it is possible to evaporate it to a greater extent, the loss of heat by blowing off is very small. The exhaust steam used for heating the sea water is all condensed and passes back with the prepared water to the hot well, and, being itself at the boiling point, all waste of heat is avoided, while the salts present in the water prevent any action on the metal, thus making it better to use than distilled water, the high solvent action of which upon metals makes it undesirable in boilers.

The opinion was freely expressed that if the process gave anything like the results at high pressures that it had done at moderate ones, it was destined to play an important part in the boiler practice of the future.

The Prevention of Phthisis.

The announcement, almost simultaneously, of two methods of preventing the development of tuberculosis has apparently made very little stir in the medical world. The medical world, in fact, is getting apathetic on the subject of cures for phthisis. Still the present claims come from the two chief bacteriological laboratories of Germany and France respectively, and are put forth by Dr. R. Koch and by Dr. Grancher, both of whom are men to be trusted. Dr. Koch asserts, as we understand him, that he has found a chemical substance which, when given to animals, prevents the development of tuberculosis in them. Dr. Grancher has obtained by cultivation a fluid with which he vaccinates animals and thereby prevents also the subsequent development of tuberculosis.—*Med. Record.*

Metallurgy in the Southern States.

Now that the members of the British Iron and Steel Institute are holding high festival in the United States, it is interesting to recall the fact that the American Union has become the first iron-producing country in the world. This proud position was long held by Great Britain; but the rapid growth of American capital and population, the vast extent of the United States, and their abounding stores of natural wealth, have all told in favor of American metallurgical pre-eminence, which has now become an accomplished fact. We have omitted to notice one circumstance which has largely contributed to the change which has taken place. We refer to the great progress which metallurgical industry has made in the Southern States during the last ten years, and even during the last five years. By the Southern States we mean Alabama, Tennessee, Virginia, West Virginia, Kentucky, Georgia, Maryland, Texas, and North Carolina. These nine States produced between them 342,537 tons of iron in 1885. In 1886 the total was carried to 415,528 tons; in 1887, to 445,226 tons; in 1888, to 485,852 tons; in 1889, to 744,610 tons; and in 1890, to 961,966 tons. Each year closes it should be observed, for the purposes of the comparison, at June 30. It is this arrangement which enables 1890 to be brought into the calculation. The progress achieved in connection with Southern metallurgy is especially observable in Alabama, which made 463,451 tons of iron in 1890, as compared with 364,346 tons in 1889, 169,696 tons in 1888, 146,280 tons in 1887, and 118,186 tons in 1886.

So confident are Alabama iron men of the future industrial greatness of the State that some of them think that it will displace Pennsylvania, which has hitherto been regarded as the great American metallurgical State *par excellence*. But the production of iron in Pennsylvania in 1889–90 having been 2,546,501 tons, as compared with an output of 463,451 tons in Alabama, it is clear that Pennsylvania will still take a great deal of beating.

Another important Southern metallurgical State is Tennessee, which attained an output of 143,693 tons in 1889–90, as compared with a production of 79,144 tons in 1884–85. The production of Virginia had also increased to 166,461 tons in 1889–90 as compared with 74,627 tons in 1884–85. On all sides Southern metallurgy is making progress, although only just a beginning has been made at present in Texas and North Carolina. As a result of the great advance which American metallurgy has been making during the last five years, the importation of foreign iron and steel into the United States has very sensibly declined. In the first half of 1887 these imports amounted to 960,649 tons, in the first half of 1888, to 472,089 tons, in the first half of 1889, to 404,591 tons, and in the first half of 1890, to 314,969 tons. Great as the consumptive powers of the Americans undoubtedly are, the enormous strides which have been made in the production of native iron have had the effect of squeezing foreign iron and steel more and more on one side since 1885, and there appears a prospect of its finally being got rid of altogether, except as regards small quantities of special descriptions which enjoy a practical monopoly.

The basis of the metallurgical industry of any country is the quantity of pig which it makes; and in this respect the Americans have been making marvelous advances every year since 1886. In that year they made 2,954,209 tons of pig; in 1887, 3,415,210 tons; in 1888, 3,382,502 tons; in 1889, 4,100,995 tons; and in 1890—that is, in the twelve months ending June 30, 1890—5,109,737 tons. The production has thus almost doubled itself during the last five years; and, notwithstanding this extraordinary result, there have been no important accumulations of stocks. Upon the whole, everything appears to show that American metallurgical progress rests upon a solid and substantial foundation. It is one thing for a country to produce so much pig, or so much iron, and another thing to dispose of it; but the Americans appear to have accomplished both results, and they may look accordingly with confidence to the course of events in the future. Many circumstances, of course, tell in favor of American metallurgy besides those at which we have already glanced. In the first place, the cheaper rates of interest now ruling in the United States are calculated to encourage enterprise of all kinds, and especially railroad enterprise; in the second place, there is not likely to be so much difficulty in future in regard to supplies of labor; and, in the third place, the extension of railroads in the Southern States not only supports the demand for railroad iron, but also facilitates the delivery of metallurgical products of all kinds to remote and formerly inaccessible districts.—*London Engineering.*

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Correspondence.

Work of Amateur Electricians.

To the Editor of the Scientific American:

Noticing your request, "electrical amateurs please report," I take leave to state that I made a four-cell battery like the one described in the SCIENTIFIC AMERICAN, with the exception that I cast my zinc plates from ordinary sheet zinc, and made my carbon plates by binding together carbon pencils obtained from the electric lamps. I also fastened all my plates for the four cells in one piece of wood, so that I could lift them all out of the tumblers at the same time.

I use in connection with the battery an induction coil, a small Gramme motor, described in "Experimental Science," electric bells and electro-magnets, all of my own construction. I also use it to light a two-candle power Edison electric lamp of 4.2 volts, which it lights brilliantly. H. A. DAWLEY.

Chillicothe, O., October 6, 1890.

To the Editor of the Scientific American:

My experience in making electric motors, according to directions in your valuable paper, is as follows:

I first made simple electric motor with ring armature, but could only get on ten coils No. 16. It gave good results. I then made one two-thirds size linear, with drum armature wound with No. 18, and having two layers only on armature. This ran sewing machine very well.

My last is a vertical single limb machine with cast iron field magnets. Core circular, 1¾ inches diameter, 2½ inches long. Pole pieces, 2½ inches broad, bore 2⅛ inches diameter. The cores are wound with No. 18. About 390 turns on each leg, having eight layers, in four coils of two layers, as in eight-light dynamo. Drum armature wound with 320 turns No. 18, in eight sections of four layers.

Using it as a series machine with coils of F. M., two in parallel, equal to four layers No. 15, and with four cells bichromate battery, elements 3 inches by 2 inches, it drives a sewing machine at about 400 revolutions—fast enough for household use.

As a shunt dynamo, driven at the rate of about 4,500 revolutions, it lights two one-candle four-volt lamps in parallel.

With thanks for the satisfaction and instruction I have derived from your paper, I am yours,

Galveston, Oct. 8, 1890. J. E. BURK.

How to Cure Felons.

To the Editor of the Scientific American:

I notice in a recent issue a cure for felons. I will give you one that I discovered accidentally, when a young man.

I was engaged in marking iron with white lead and turpentine, and having a felon coming on my finger, dipped it frequently into the mixture. As the iron was quite warm which I was marking at the time, I found the next morning that there was a small yellow spot where I felt the felon. I opened this, and had no more trouble from it. The next time I felt one coming I procured some turpentine and bathed the part affected frequently, and held it near a warm surface to dry, with the same result as the first. Since then I have used it several times, always with the same result. I also have had others try it, among them some of our men who work in the rolling mill, whose hands are covered with a very hard skin, and every one of them who tried it met with the same results, saving them a great deal of time, money and pain.

I asked an eminent physician why the turpentine should produce such a result. His answer was, "It is a counter-irritant." JAMES MALLEN.

Simple Methods of Copying Letters.

To the Editor of the Scientific American:

In a recent issue of your valuable paper, you answer a question (No. 2459) concerning a cheap method of letter copying. Let me describe the method I have used for some years.

I went to a printing office and had tissue paper put in a pad with stitched ends at a cost of 25 cents a hundred pages, 9½ by 11½. The cover is simply of thick paper, the bottom of cardboard.

To copy, I use ordinary copying ink—Carter's, Stafford's, or Arnold's—a cotton or woolen cloth, or a blotting paper dampened. "Pack" same as for a press and roll with common pastry roller.

Detached sheets of copy may be taken by "packing" on a cardboard and passing through a common clothes wringer. The cardboard is for strength, to avoid tearing the tissue. This method is as good as any press made, if carefully handled.

Another method is to arrange the original, tissue, wet cloth, and wrap all around a walking stick or piece of curtain roller, then roll with hands, or putting the packed roll on a table, roll it back and forth a few times beneath a board pressed upon it.

J. A. LONG, *Pastor M. E. Church,*

Castle Rock, Col.

Annual Report of the Commissioner of Patents.

The annual report of the Commissioner of Patents, C. E. Mitchell, to the Secretary of the Interior for the fiscal year 1889–1890 is a plain, concise, and practical document. We make the following abstract:

The total number of applications received, including designs, reissues, etc., was 46,140; the number of patents granted was 27,493; the total receipts were $1,347,203.21; the total expenditures were $1,081,173.56, leaving a surplus of $266,029.65 to be turned into the Treasury of the United States to the credit of the patent fund, and making a total balance in the Treasury on account of the patent fund of $3,790,556.28.

The commissioner says:

"It is not without some satisfaction that I direct attention to the fact that despite the great increase in the number of applications, the number on hand in condition for action at the end of the last fiscal year was less than at the corresponding period in either of the four previous years. This result is due not to any increase in the number of employes or to any additional facilities whatever, but is to be ascribed to the unflagging industry and well directed skill of the entire force under my control.

"The present force of the Patent Office is inadequate. I have no reason to believe that the great increase in the amount of work done during the past year has been accompanied by any deterioration in its quality. On the contrary, I believe that such is not the fact. At the same time it must be admitted that the pace kept up in the Patent Office now, as during all recent years, is inconsistent with that high degree of care in conducting examinations which the patent system calls for. The government undertakes on behalf of the inventor not only to give him a patent if his improvement is new and useful, but to conduct a painstaking examination in order to ascertain what the fact is in that regard. The fees paid by the inventors for that purpose are ample, as is abundantly proved by the surplus over and above all expenses which, increasing yearly, is paid into the Treasury by this office under the present system. There can be no excuse, excepting inadequacy of force, for failure to make the examinations thorough and exhaustive, and inadequacy of force, though it may excuse the Patent Office, is no excuse for the government. The search for anticipating devices and processes should continue until a moral certainty."

In the opinion of the commissioner, an increase in the examining force of the office is imperatively demanded. He justly says:

"A patent should evidence such painstaking care in examination that upon its face it should warrant a preliminary injunction, and there can be little doubt that the permanence of the American 'examination system' depends upon so conducting the examinations into the novelty of alleged inventions as to make the seal of the Patent Office create a powerful if not a conclusive presumption that the patent is valid. I am aware that after the most exhaustive examination there still will remain a margin of possibility that the result of the examination is not to be relied upon. No examiner can possibly be aware of all that has been done which has not found a place in patents or in printed publications; but in this age of printing and publicity there is no reason why an examination sufficiently painstaking and exhaustive should not afford a practical guarantee that the patented thing was original with the patentee. Because, then, of the large increase in the number of applications for patents, and because of the necessity of more deliberate and exhaustive examination, and because of the fact that American inventors are already paying the necessary expenses, I recommend a substantial increase in the examining corps of the Patent Office."

The commissioner presents most cogent reasons why the salaries of examiners should be increased:

"The salary of the principal examiners is $2,500. This salary was fixed by Congress in 1848. But a salary which was just in 1848 is not just in 1890. Aside from the fact that all salaries have been increased, on account of the increased cost of living, the present examiners of the Patent Office do far more and better work than was done by their predecessors forty years ago. Owing to the wonderful progress in every art, they are required to be much more learned. They are now experts of the highest order; they have legal ability and executive capacity. And what is true of the principal examiners is true in a proportionate degree of the assistant examiners, whose salaries ought also to be augmented. The Patent Office cannot expect to maintain an examining corps of the highest order of ability unless the salaries are made commensurate with services rendered, and no one who has ever considered the subject has ever maintained that salaries established forty years ago are now just or reasonable."

An important change in regard to the status and functions of the board of examiners-in-chief is recommended. At present the examiners-in-chief have jurisdiction over appeals from the decisions of the primary examiners and the examiner of interferences. From all decisions of the examiners-in-chief further appeal lies to the commissioner.

"I am satisfied," says the commissioner, "that this latter appeal should be done away with. The term of office of the examiners-in-chief is permanent, and the highest appellate tribunal of the office should, like other judicial bodies, possess a permanent tenure. Another reason is found in the fact that with the growth of the business in the Patent Office it has become impossible for the commissioner to discharge properly his appellate judicial powers as now devolved upon him by law.

"The number of written decisions rendered by the commissioner and assistant commissioner in appellate proceedings during the last fiscal year was eight hundred and twenty-five. About two hundred were rendered in cases that came up on appeal from the examiners-in-chief. Some of these cases presented important questions involving the patentability of inventions, and others involved the determination between rival claimants of the question which was the original first inventor. I am satisfied that no appeals should come to the commissioner from the examiners-in-chief, and that his judicial jurisdiction over that body should go no farther than to grant new trials and rehearings in proper cases, according to the principles regulating such proceedings. Such a change in the organization of the Patent Office would relieve the commissioner of a portion of that burden which is now too great to be properly discharged. It would save litigants the expense, annoyance, and the delay of two appeals, where one should be sufficient, and it would secure that uniformity in decisions which the original act creating the board contemplated. The members of the board should receive the same compensation as the judges of the United States district courts, and be required to possess the same qualifications for the discharge of judicial duty. I think, too, they should be five in number."

The Benefit of Newspaper Training.

I believe I have done everything which an editor or publisher ever has to do, from directing wrappers up to writing the biography of a president within an hour after his death. This means, if the training be continued through many years of life, and if one be under a good chief, that one gains, of necessity, the ready use, at least, of his own language. We newspaper men may write English very ill, but we write it easily and quickly. So that to us, who have been in this business, there is something amazing to hear a clergyman say that he occupied a week in composing a sermon, which was, at the outside, thirty-five hundred words in length. One can understand absolute inability to do it at all; but no newspaper man understands how a man, who can do it, can spend thirty-six hours in doing it. If you have to send "copy" upstairs, hour after hour, with the boy taking slips from you, one by one, as they are written, and you know that you are never to see what you write until you read it the next day in the paper, your copy will be punctuated carefully, written carefully, and will be easily read. That is one thing. Another thing goes with it. You will form the habit of determining what you mean to say before you say it, how far you want to go, and where you want to stop. And this will bring you to a valuable habit of life—to stand by what has been decided. Napoleon gave the same advice when he said, "If you set out to take Vienna, take Vienna." For these reasons, I am apt to recommend young men to write for the press early in life, being well aware that the habit of doing this has been of use to me.—*Edward Everett Hale, in the New York Forum.*

A Point of Partnership Law.

In the Supreme Court, Brooklyn, Judge Cullen has rendered a decision that will interest business men everywhere.

Enoch Rutzler and George W. Blake had been for five years partners in the steam heating business on Center street in this city. The copartnership was recently dissolved, and Blake started in the same business in Wooster street. He then moved to enjoin Rutzler from continuing the business at the old stand or anywhere else in New York in connection with the firm name. Judge Cullen lays down the law as follows:

"The authorities are plain that in the dissolution of a partnership or the sale of a business with its good will, in the absence of any covenant to the contrary, either partner or vender may prosecute the same business at any location, even next door to the premises occupied by the firm. In such cases the good will amounts to nothing more than the probability of the customers resorting to trade at the old stand. Defendant Rutzler, therefore, has the right to carry on his business at the premises he has hired for that purpose."

The court goes on to explain that Rutzler may not describe himself as the successor of the late firm, nor put out any sign or publish any advertisement calculated to mislead the public to believe that he is the successor or is continuing the business of the old concern. He may, however, describe himself as "lately a partner in the firm," or as being "formerly with it."

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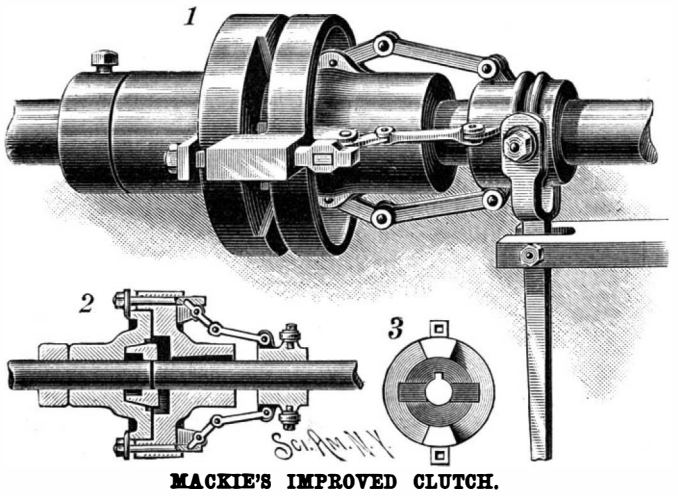
A NEW CLUTCH.

The engraving shows a new clutch which has been recently patented by Mr. David Mackie, of 4062 Lancaster Avenue, West Philadelphia, Pa., in which all the advantages of a friction clutch and a positive clutch are combined. Fig. 1 is a perspective view of the clutch, Fig. 2 is a longitudinal section, and Fig. 3 is an end view of one-half of the clutch.

Upon the ends of the shaft sections to be connected by the clutch are mounted flanged collars, one of which is provided with a conical recess, while in the other is formed a cylindrical recess in which is placed a cone provided with arms projecting into mortises in the flanged collar. The cone is arranged to be moved forward into the conical recess of the opposite portion of the coupling by a pair of levers connected with a sliding circumferentially grooved sleeve, which is engaged by a forked lever provided with inwardly-projecting studs. The flanged collar having the conical recess is capable of sliding upon its shaft, but is prevented from turning thereon by slots and feathers. The flanged collar in which are pivoted the levers is furnished at its periphery, at diametrically opposite sides, with sockets for receiving sliding rods, which are provided with heads reaching inwardly over the movable flanged collar. Levers pivoted in ears projecting from the fixed flanged collar extend into mortises in these sliding rods, and are connected by links with the sliding sleeve by which the clutch is operated. The flanged collars on their adjacent faces are provided with lugs which are capable of engaging each other when the collars are drawn together.



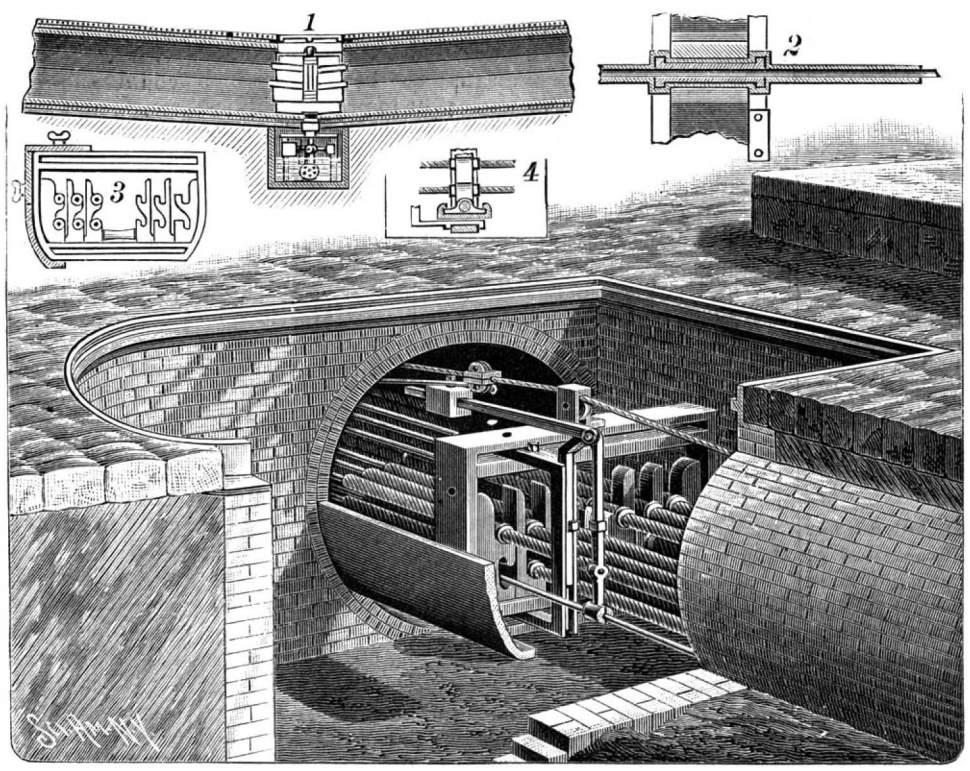
MACKIE'S IMPROVED CLUTCH.

The operation of this improved clutch is as follows: When the clutch lever is moved in a right-handed direction, the cone is pushed forward into the conical cavity by the action of the levers. By this means the driven shaft is made to gradually acquire the same motion as the driver. As soon as this is accomplished, the clutch lever is quickly moved in the opposite direction, thus withdrawing the cone from the conical cavity, and at the same instant carrying forward the movable flanged collar through the medium of the sliding rods, so as to bring the lugs into engagement with each other, thus securing a positive connection of the two shafts. When the shafts are to be detached, this operation is reversed.

It will thus be seen that in this device all of the advantages of the friction clutch and the positive clutch are secured.

NEW ELECTRIC CONDUIT.

The engraving shows in perspective and detail a new electric conduit patented by Mr. C. Edward Loth, of 88 Congress St., Troy, N. Y. This conduit is specially designed for facilitating the laying and adjusting of the wires, and for cheapening the construction of the lines, by doing away with the necessity of insulation except at or near the points of support. This system also provides means for gathering and removing water which may accumulate. At suitable intervals along the conduit are arranged manholes like that shown in the engraving, in which are placed supports for receiving the conductors. These supports are placed in a frame held in a vertical position in the manhole. They are capable of being moved in the frame to permit of introducing or arranging the wires. The wires are drawn through the conduit by means of the cable shown in the larger view, which carries a clamp for receiving the end of the wire. As the cable reaches the roller on the top of the frame in the manhole, the clamp is detached from the cable, the wire is passed through the frame, when the clamp is again attached to the cable upon the opposite side of the frame, and the wire is drawn forward as before until the next manhole is reached, when the operation is repeated.



LOTH'S UNDERGROUND ELECTRIC CONDUIT.

It is desirable to maintain a certain tension on the wires during the operation of introducing them into the conduit, and for this purpose a right-angled lever is provided, having on its vertical arm a clamp for receiving the wire, and on its horizontal arm a weight for giving the wire the requisite tension. The wire is provided with an insulating covering for a short distance on opposite sides of the supporting frame in the manhole, and is furnished with a sleeve which rests in the support and serves to retain the wire in its position and under proper tension. The sections of the conduit incline toward the manhole, and each manhole is provided with a pipe leading to the suction pipe of the pump, several of the manholes being connected with a single pump. It will be noticed that the pits for receiving the water at the ends of the sections are enlarged laterally to give them increased capacity. These pits are furnished with benches or platforms, upon which the linemen may stand while adjusting the wires.

Fig. 1 shows the inclination of the conduit, section of the water pit, and the float valve for closing the suction of the drainage pipe as the water is removed, so that the pump may act upon the water in the other pits. Fig. 2 is a sectional view of the fastening device for holding the wire in the support. Fig. 3 is a side elevation of the frame and the wire supports; and Fig. 4 shows a support provided with a roller, over which the wire is drawn while it is being introduced into the conduit.

This improved conduit has the advantage of affording free access to the wires, and it may be constructed at a minimum expense, as the wires for the greater portion of their length may remain uninsulated.

Gem Mining in Siam.

Of late a good deal has been heard of concessions for gold and gem mining in Siam. The British Consul-General at Bangkok, in his last report, devotes some space to both subjects. As to gems, he says that the region in which rubies and sapphires have for the past ten years been found lies on the western side of the Cambodian peninsula, about 240 miles southeast of Bangkok, and covers approximately an area of 100 square miles. The center of this district is Chantabun, a seaport with a good harbor, connected with Bangkok by a line of three small steamers running at regular intervals. Within three hours, to the northwest, is Ban Kacha, where rubies of a very inferior kind are still sought by the local inhabitants, both Siamese and Chinese. Tongsoos, or natives of Pegu, and Burmese do not work here. Then, again, 12 hours from Chantabun, lying east by south on the western side of a range of hills, are the mines of Muang Krung, with a mining population of about 100 in all, mostly Tongsoos, with a few native Siamese and Chinese. Two days from Chantabun, in a southerly direction, is the district of Krat, with mines from which rubies are extracted, and but few sapphires. The Tongsoo workers here number about 3,000. On the eastern side of the hill range, midway between Chantabun and Battambong, are the Phailin mines, the most extensive and the most frequented of all. Here there are between 4,000 and 5,000 gem seekers. Rubies and sapphires are both found, the latter being more abundant. All three of these localities—Krung, Krat, and Phailin—have been, or shortly will be, conceded on mining leases, the last to an Italian and the two former to a Chinese British subject and an Englishman respectively. The method of obtaining the precious stones is identical at all the diggings in this region. The digger, on entering the district, pays 5s. 6d. to the headman, a Burmese British subject responsible to the local governors. Beyond this no further fee is exacted. The Siamese claim no right of pre-emption over gems found, or of purchase at market value of all stones above a certain weight, as was the case in Burma. The Tongsoo digger's first object is to discover a layer of soft, yellowish sand, in which both rubies and sapphires are deposited. This stratum lies at depths varying from a few inches to 20 ft. on a bed of subsoil, in which no precious stones are found. A pit is dug, and the soil removed is taken to a neighboring canal or stream, where it is mixed with water and passed through an ordinary hand sieve. In his search for this peculiar alluvial deposit, which is generally free from any admixture of clayey earth, the digger has often to penetrate into the jungle that grows thick around, and combine the work of clearing with the occupation of gem digger. The Tongsoos do not appear to form themselves into companies for mutual assistance or division of profits. They work principally in twos or threes, and if chance lead them to discover a gem of any value, they either undertake a sea journey to Rangoon or Calcutta for the purpose of obtaining a good price for it themselves, or consign it to an agent, while they themselves continue to search for more. No sapphire has yet been extracted of higher value than about £280, nor ruby of higher price than £960. A process of migration is continually going on among the Tongsoos of the different mines, the workers passing from one to the other, according to the reputation of a particular mine at certain periods. No artificial or mechanical processes for washing the soil have as yet been introduced. Rubies and sapphires are found at all the diggings, often deposited side by side in the same layer or stratum of sand. The ruby of "pigeon blood" color is rarely, if ever, met with. The color of the Siam ruby is usually light red of a dull hue. The sapphire is of a dark, dull blue, without any of the silken gloss which is the distinctive mark of the Burma and Ceylon stone. Stones resembling garnets rather than rubies are found in the dried beds of watercourses at Raheng, 200 miles north of Bangkok; and there is every reason to believe that rubies also, equal, if not superior, to those discovered in the southeast, exist throughout the Raheng district. Those hitherto obtained are the result merely of surface scratchings by Tongsoo seekers.

Cremation at Milan.

Two systems of cremation are followed at Milan, by one of which the body is burned in a furnace surrounded by wood and charcoal, while by the other the combustion is brought about through a number of jets of gas which cast their heat upon the furnace from all sides. When wood and charcoal are employed, about six hundred pounds of wood and one of charcoal are found necessary, and the process lasts two hours. When gas is used, all that is consumable in the body is burned up in less than fifty minutes. The body may, in ordinary cases, be introduced into the furnace with or without the coffin. But if death has been caused by some infectious disease, the coffin and body must be burned together. The weight of the remains after cremation, in the form of bones and dust, is about four pounds. They are in color pure white, tinged here and there with a delicate pink; and it is a rule never to touch them with the hand. The bones and vestiges of bones (which are for the most part burned into powder) are taken up with silver tongs, while the ashes are removed from the furnace with a silver shovel, to be placed on a silver dish and then deposited in an urn for retention in the cinerarium. Here the ashes are preserved in separate compartments, each with a suitable inscription beneath it. The cost of cremation is $5 to a member of the Society for Extending Cremation in Italy, or $10 in the case of non-members.—*Med. Record.*

MEDICAL students in London are compelled to go through a course of four years' study, hospital attendance and lectures before being qualified to appear for the final examination. By an order of the General Medical Council of England the term of preparation has been extended to five years.

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EXPERIMENTAL PLANT OF THE PORTELECTRIC SYSTEM.

It is now something more than a year since the exhibition of the model of the portelectric system in the Old South Church in Boston. The subsequent description of this promising invention in the daily newspapers and technical journals attracted the notice of people in all parts of the world. It was at once recognized that, could the model be duplicated on a large scale, and be made to work with the same degree of success, its commercial utility and importance in the rapid transportation of mail and express packages would be very great

Since the invention was first exhibited to the public, its projectors have been busily engaged in the construction of an experimental track upon which the "portelectric" car could be tested under conditions similar to those which would be met in actual practice, and fully as severe as those which would be encountered in commercial operation.

This experimental plant, which is located near the Howard street station on the New York and New England Railroad, in the suburbs of Boston, has been completed and in experimental operation for some time, but its construction and operation have been open to the inspection of the public only since the 11th of this month. Notwithstanding the difficulties, mostly of a mechanical nature, which necessarily had to be met and overcome in pioneer work of this kind, the experimental work has proved so successful that the performance of the system re-enforces the opinions formerly held by its projectors concerning its future commercial importance.

The system is intended for the transportation, not of passengers, but of mail and express matter only, at rates of speed approximating two miles per minute, the steel car being drawn along its confined path at this high rate by the pull of numerous solenoids through which the track is laid, each coil exerting its power for a short time only as the car approaches it.

In general principles the experimental track here described and illustrated does not differ from the model exhibited in the Old South Church last year. In the mechanical details, however, such changes have been made as have been found by actual experiments to be necessary to adapt the system to the requirements of commercial service.

The method of closing and opening the circuit through the track solenoids at the proper time has been changed. The mounting of the car upon its wheels, the construction of the track and some other mechanical details have been greatly improved. Prof. A. E. Dolbear, the electrician of the company, and Mr. John T. Williams have given the matter almost daily attention for several months, and especial care has been directed toward the reduction, as far as possible, of the copper wire required in the coils of the track solenoids.

The experimental line is nearly 3,000 feet long, built in the form of an oval or somewhat of a pear shape, including two curves of different radii, some straight and level sections, and grades, both on a straight track and on curves. One grade is 8 per cent and another 11 per cent. Posts 10 inches square are set solidly in the earth to a sufficient depth to be undisturbed by frost, and are packed about with sand. These posts project above the surface to a height of about four or five feet, and to their sides, at the top, are strongly bolted planks, three by ten inches, set on edge and carefully fitted, so that the top of the planks is flush with the top of the posts. Posts are set at intervals of six feet. This low structure was so built simply for convenience of access in conducting experimental investigation.

A very neatly designed and well constructed power house stands directly over the track, as is shown in the illustration on this page. Its architectural features are the design of Mr. J. Philipp Rinn, a Boston architect. The track passes directly through its center at a distance of about two feet from the floor. The building is surmounted by a lookout tower, from which the car may be watched as it speeds around its half mile course.

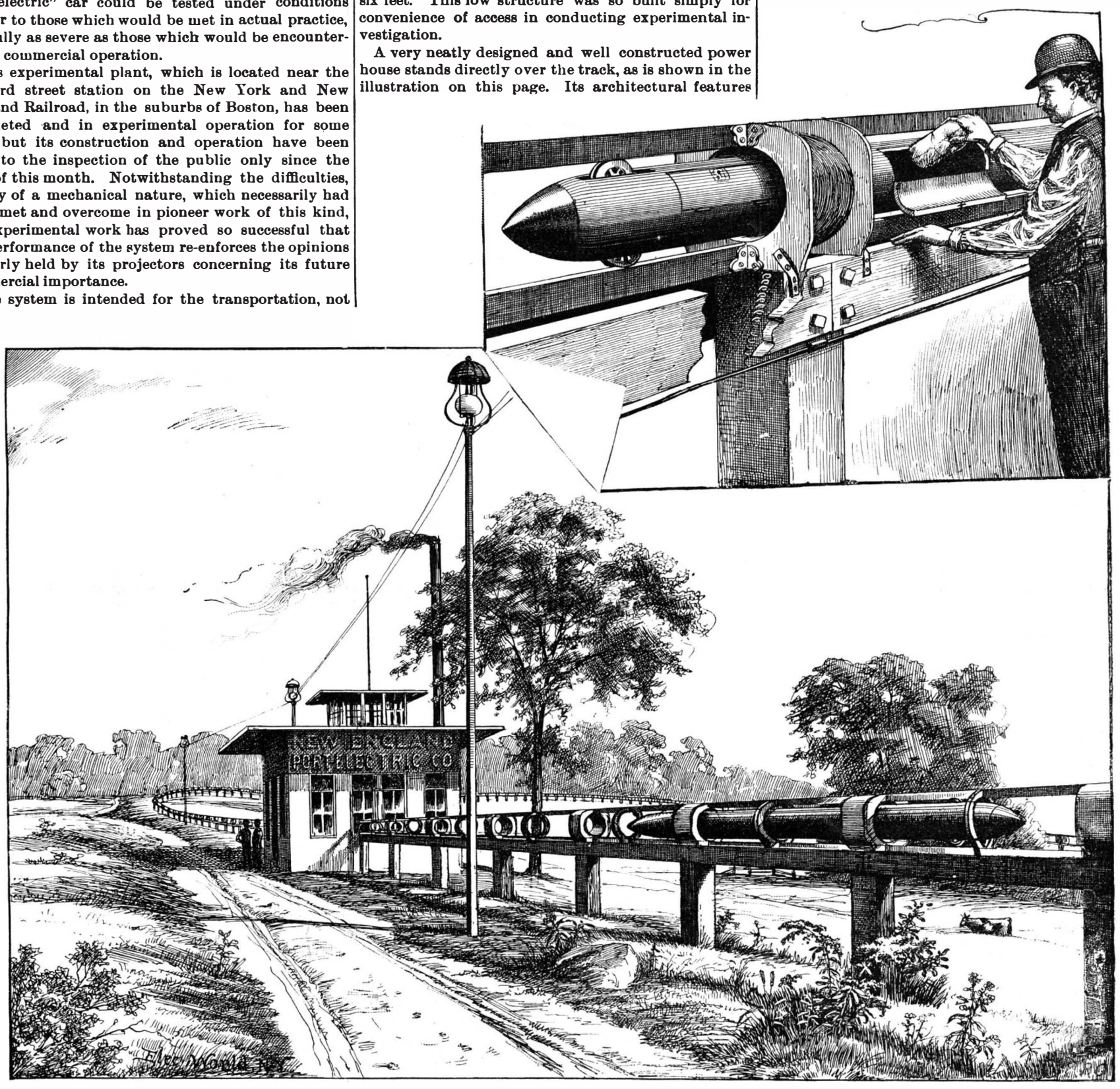
The power equipment of the station consists of a Sturtevant 20 h. p. engine and an Edco dynamo to furnish current for the propulsion of the car. This dynamo is wound for a pressure of 1,000 volts. A horizontal tubular boiler supplies steam for the engine and for the heating of the building as well. A small supply and work room is conveniently arranged in one corner of the building. The station is lighted by Bernstein series incandescent lamps, and the track is lighted when necessary with seven arc lights.

Upon the heavy framework of wood of which the track structure is composed are placed the solenoids, a series of coils extending along the entire track at intervals of six feet. These coils have an internal diameter of eleven inches, and are each made of about 20 pounds of No. 14 wire. The two rails of the track extend through these coils, one at the top and the other at the bottom. The lower track is in connection with one terminal of the dynamo, and the other terminal is connected with a lead wire parallel with the lower track. To this wire are attached branches connecting it to the various sections of the upper track, these sections being about six feet long. The passage of the car completes the circuit between the upper and lower rails through the solenoid in advance of the car, and the car is thus pulled into the coil until it is midway through the coil, when the current is cut out and transferred to the next coil in advance.

The car is an iron cylinder 10 inches in diameter, and, with its conical ends, is 12 feet long, and weighs 350 pounds. It runs on two wheels, and also has guide wheels to run on the track above the car. Doors upon its side allow of the necessary matter constituting the load of the car to be placed upon its inside and securely locked in place.

The greatest difficulty experienced in the operation of this track and car was in the adaptation of the car to the compound curve, made up of a grade and a curve of short radius. It was found necessary to make the car itself rotate to accommodate itself to the curve and grade, thus introducing a great frictional resistance. In spite of this, however, the car has been drawn about the oval track in about one and a half minutes, and its speed has reached about 45 feet per second. The greatest acceleration observed was about 3½ feet per second, which, if maintained for a minute, would give a speed of about two miles per minute. The shape and difficulties of the present track, however, prevent the acquiring of such a speed.

In forming an opinion of what has been already accomplished by the plant described above, it should be borne in mind that the whole project was so new that every step has had to be taken without the assistance of any precedent, or of the experience of others in simi-



EXPERIMENTAL PLANT OF THE PORTELECTRIC SYSTEM OF TRANSPORTATION, BOSTON, MASS.

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lar work. Its growth, however, has been very satisfactory, and Professor Dolbear asserts that there is every reason for thinking that in a short time the car will be capable of running away from the swiftest express train.—*Electrical World.*

PHOTOGRAPHIC NOTES.

How to Utilize Light-struck Plates.—It often happens that through carelessness or accident sensitive dry plates become light-struck. Instead of being thrown away as useless, the plates may be doctored so that they can be used in the camera, though their rapidity may be somewhat decreased.

The *Br. Jour. of Photo.* advises that the damaged plates be immersed for five minutes in the following solution :

Bichromate of potash	1 ounce.
Hydrobromic acid (sp. gr. 1,400)	2 fluid drachms.
Water	10 ounces.

If hydrobromic acid is not obtainable, hydrochloric acid or a soluble bromide may be used, to which a few drops of sulphuric acid should be added. After immersion the plates should be carefully washed and reared up to dry. Their sensitiveness will be increased by immersing in a plain alkaline solution for two or three minutes.

Subterranean Photography.—A Mr. Langlois has constructed an apparatus for photographing underground where the only means of access to the locality is a narrow shaft. The camera is very small, holds a 2 inch square sensitive plate, and has a lens of very short focus.

The whole is placed in metal case or tube, open on one side, and can be lowered by means of a cord or small chain attached to the tube. The camera is pivoted within the tube, at its upper end, so that it can be kept at an angle by means of another cord or small chain fastened to its lower end. Above and below the camera are arranged rows of small incandescent electric lamps.

When the apparatus is lowered, and the camera made to incline outward from the case, the current is turned on and the plate exposed. The photographs thus obtained are said to be excellent.—*Mechanical World and Photo. News.*

Method of Holding Separate Celluloid Films in the Dark Slide.—Says Ethel C. May on this subject, in a communication to the *Br. Jour. of Photo.* : "We are generally instructed to lay the films in the holder like a glass plate, and to back them with a piece of cardboard. But the film and backing often slip back and get out of register.

"The plan I have adopted is to take some dark chocolate-colored mounts, and with heavy scissors trim them down 1-64 of an inch smaller than the rabbet of the dark slide. Take some strips of gummed paper, the same as that on the margin of postage stamp sheets, and fasten one over each corner of the card, gluing it firmly to the back by the glue which the strip possesses, taking care not to moisten the corner itself. When dry, slip the celluloid films under these corners, and they will be found to lie beautifully flat, and can be laid in the slide just like a plate. Over them I lay a piece of pretty stout mill board or Eastman's film carrier board, and close the slide, being careful that the pressure of the spring of the partition is only just sufficient to keep the films up to the rabbet. Instead of the spring board a tuft of cotton can be used, large enough to act as a spring in keeping the films pressed outward."

The extreme thinness of the paper at the corners prevents any possibility of the film being out of register, a point which is likely to occur if metal corners are used. The foregoing description applies to the book slide, which opens like a book. For plates which slide in the holder it may answer equally as well.

Process of Toning Dry Plate Lantern Slides.—Mr. W. P. Christian, of the Liverpool Amateur Photographic Association, as reported in the *Br. Jour. of Photo.*, suggests the following modification of Mr. G. F. Blackmore's formula :

After the slide has been developed, wash under the tap, and before fixing bleach it in a bichloride mercury bath—

Bichloride mercury	1 ounce.
Water	20 ounces.

Then wash well and immerse in the following bath :

No. 1.

Water	14 ounces.
Hyposulphite of soda bath (1 ounce to 6 ounces of water)	3 minims.
Sulphocyanide of ammonia	40 grains.

No. 2.

Chloride of gold	5 grains.
Water	2½ ounces.

The bath is made by adding half an ounce of No. 2 to two ounces of No. 1, and should be kept mixed a few days, as it works better. The tones produced vary from yellowish brown to golden brown and deeper brown, passing afterward to purple and steady blue black.

The time of toning may be accelerated by adding more of the gold solution. More hypo gave a yellowish brown tint or more sulphocyanide a blackish brown. He preferred a bath rich in gold, which gives a peculiarly warm, luminous character to the slide. Other range of tones could be effected by dipping the plate in the gold solution (one grain to one ounce) alone just after bleaching, before putting it into the toning solution. If chloride plates are used, the bleaching is not necessary. Any yellowish stain in the slide after toning is removed by immersing in a weak bath of hydrochloric acid and water.

The principle of this toning process is to first convert the reduced bromide image into a chloride, by means of bichloride of mercury, then to tone and fix it at one operation in the sulphocyanide and hypo gold bath. Care should be taken not to develop the slide too far, otherwise it may be too dense.

An Eikonogen Developer, said to be very simple, and to work good for lantern slide plates, is advised by T. A. Sinclair, of the same association :

No. 1.

Eikonogen	½ ounce.
Sulphite soda	2 ounces.
Water	20 ounces.

No. 2.

Washing soda	2 ounces.
Carbonate of potash	2 ounces.
Water	20 ounces.

Take one ounce of No. 1, half an ounce of No. 2, and add half an ounce of water. This will develop eight or ten plates in succession.

New Use of Eikonogen in Reversing the Photographic Image.—That eikonogen is adapted to produce a positive image as well as a negative, on plates exposed directly in the camera, is one of the latest discoveries of its probable many uses. It was discovered accidentally.

We refer to the recent published reports of the experiments of Colonel Waterhouse, of Calcutta, India, who, in trying to find some good preservative for the eikonogen solution, accidentally noticed that a certain chemical added to the solution developed a plate into a positive instead of a negative. The chemical is called thio-sinamine, or allyl-thio-carbamide, the formula of which is—

$$C.S:\begin{matrix}NHC_3H_5\\NH_2\end{matrix}$$

He says of it : It is prepared by treating allyl-thio-carbamide, or the essential oil of black mustard, with ammonia ; is more soluble in cold water than the phenyl-thio-carbamide, and is also soluble in alcohol. A nearly saturated solution can be made by adding four parts of the strongest liquor ammonia to one part of the ordinary essential oil of mustard obtained from the druggist. As soon as the ammonia has taken up as much of the oil as it will, the solution may be decanted off and the ammonia allowed to evaporate.

Of the solution thus prepared, about one part in 100 of the mixed eikonogen developer, as above, is sufficient to produce reversal on development. A little bromide may be added, and a slight trace of ammonia seems beneficial. It is advisable to evaporate the solution as prepared above, and obtain the thio-sinamine in a crystalline and odorless form, in which it may be purchased in Europe. Of the saturated solution of the crystals, from one-half to one part in 100 parts of the developer is enough.

Col. Waterhouse trys to explain the theory on which the reversal is based, and thinks the sulphur in the compound is the active agent. Over-exposure of the plate prevents reversal. He continues: "The results obtained seem to warrant the hope that it may be possible to perfect the process for practical use, but a great deal of work has yet to be done before the conditions of successful working can be fully ascertained. As in all these processes of reversal, the balance between reversal and non-reversal is a very delicate one. In any case an entirely new method of producing reversed negatives, with so many novel features, must be of interest, and, it is to be hoped, may throw some light upon the still unsolved problems connected with the formation and reversal of the developed photographic image.

"For copying line subjects, it is an improvement to use the eikonogen and phenyl-thio-carbamide developer, and before developing to give the plates a preliminary bath of dilute nitric acid at five per cent, or of bichromate of potash solution at about three or four per cent, the solutions being flowed over the plate in a tray, and washed off quickly. By this means greater density is obtained in the lines, together with clearer whites. The reversal takes place slowly, but is more complete, and the change is quite visible, the lines turning black on a light ground. Greater clearness of the ground may also be obtained by treating the plate before fixing with a solution of bromide of copper at two or three per cent. But care must be taken not to weaken the lines too much.

"In working with thio-sinamine, good reversals have been obtained of half-tone subjects by adding about ten drops of a ten per cent bichromate of potash solution to the ounce of eikonogen developer.

"For copying work the process seems quite practical, as proved by heliogravure plates produced directly from the reversed negatives taken in the camera, by which one operation (either the taking of a negative or of an intermediate positive) is saved." We extract the foregoing from the *Br. Jour. of Photo.*

We have been unable to find the thio-sinamine in stock at some of the largest dealers in rare chemicals in this country, but were informed that it could be obtained from Germany at a cost of one dollar per half-ounce. We have not yet tried it, but believe Col. Waterhouse's deductions to be reliable.

When the process is fully worked out, it may be possible to make successive exposures of one landscape on a roll of bromide paper which may be developed out as positives, and thus avoid the interposed negative. It seems remarkable that such an important discovery should be made within a year of the introduction of the eikonogen developer.

Alternating versus Continuous Currents in Relation to the Human Body.

BY H. NEWMAN LAWRENCE, M.I.E.E., AND ARTHUR HARRIES, M.D.

This was a paper lately read before the British Association. The authors say their experiments were made :

1. By using currents directly from lighting circuits, both alternating and continuous.

2. By using currents directly from a dynamo whose rate of alternation could be accurately ascertained.

3. By using currents of high E. M. F.

4. By using an instrument for the measurement of alternating currents whose accuracy has been tested and proved to give correct readings by an eminent practical electrician.

Another practical point to which special attention has been given in this paper is that the experiments have been made chiefly with the skin in a state of nature, so that the conditions of experiment as nearly as possible resemble those which might be expected to exist under accidental circumstances—that is to say, under circumstances when contact with conductors was unexpected, and, therefore, unprovided for.

We omit the details of the various experiments. At the end of the paper the authors say :

We will now briefly summarize our conclusions, and in doing so desire to draw attention to the fact that they are based upon certain conditions, and while we believe them to be sufficiently accurate and reliable under these conditions, we in no sense claim them as true under all conditions.

Conclusions.

A. When the human body, with its skin in its normal unmoistened condition, comes into contact for an appreciable time with bare metal conductors of a dynamo-generated continuous current passing at about 100 volts, in such a way that the current passes from hand to hand, and the total contact area is about 90 square centimeters :

(1) A current of about 0·016 ampere will pass through it.

(2) This current can be borne without discomfort for 15 to 30 seconds.

(3) After about 30 seconds unpleasant burning sensations become marked and quickly increase.

(4) The subject is perfectly able to release himself at will during any portion of the time of contact.

B. When the human body comes into contact with dynamo-generated alternating currents, alternating at about 60 to 70 per second, under the same conditions as above :

(1) A current of about 0·025 ampere will pass through it.

(2) The current is six times greater than that which produces discomfort.

(3) Instantly the subject is fixed by violent muscular contraction and suffers great pain.

(4) The subject is utterly unable to release himself, but remains exposed to the full rigor of all the current that may be passing.

C. When circuit from electric light or power conductors is accidentally completed through the human body, the danger of serious consequences is many times greater when alternating than when continuous currents are passing at equal voltage, and this is still to a large extent true if the voltage of the continuous current be double that of the alternating.

D. (1) With both forms of current a reduction of contact area materially reduces the amount of current strength that passes.

(2) With the alternating current, if the rate of alternation be reduced below 50 per cent, the sensations of pain accompanying muscular fixation will be increased, while if the rate of alternation be increased, the pain will be diminished.

Finally, we would remind those gentlemen who so commonly speak as if voltage were the chief or only factor in the danger of accidental contact, that *current strength is the important item*, and that according to Ohm's law current strength is dependent not only upon E.M.F., but upon the total resistance in circuit at the time of accidental contact. To make statements based upon voltage only, such as newspaper reports of a recent execution have contained, is not only distinctly misleading, but calculated to induce the uninitiated to form erroneous conclusions.

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Sugar and the Sugar Cane in Cuba.

M. Truy, French consul at Santiago de Cuba, says, according to the *Journal of the Society of Arts*, London, that the cultivation of the sugar cane in the eastern portion of the island of Cuba is almost entirely confined to the districts of Santiago, Guantanamo, and Manzanillo. This cultivation, although it has experienced some extension of late years, is not in the flourishing condition it was twenty years ago. This falling off is due to the civil war, which ruined many planters and discouraged others. The profits, however, realized for some time past by those planters who had sufficient credit, or confidence in the future, to continue to engage in this industry, have given a stimulus to the cultivation of the cane.

Sugar factories have been established in many parts, particularly in the district of Guantanamo and Manzanillo, old sugar factories have been supplied with fresh plant, and planters, encouraged by high prices recently realized, have hastened to get their ground ready for cultivation. Part of the products of the province of Santiago is shipped to Spain, and some small quantity is consigned each year to Canada, but the United States absorbs almost the whole of the yield of the island. The Cuba market was some years ago controlled by French merchants, who owned the greater part of the sugar factories of the province, but since the civil war many planters sold their estates, and retired to France.

A few estates, however, are still owned by Frenchmen, at Guantanamo especially. Those known as Sainte Marie, Sainte Cecile, and San Antonio are directed or owned by Frenchmen. All the land in the island is, in general, fit for the cultivation of the cane, an even surface being generally chosen, with a view to facilitate the working and the harvesting. The ground should also be as near the sea as possible, so as to avoid the cost of carriage and transport, which is particularly high in that part of the island, where it may be said there is an absence of railroads, and the carriage roads are in a deplorable condition. If the ground chosen is one that has hitherto been uncultivated, the planter, first of all, clears it in cutting down the branches of the trees and small shrubs with the machete, and burning the larger trees. The expenses of these preliminary operations may be estimated at from four hundred to five hundred dollars per plantation of thirteen hectares (the hectare is equivalent to 2·47 acres).

Holes are then dug at intervals of from three to four feet, and in them are placed horizontally pieces of cane of a length from two to three joints. If the ground has previously been under cultivation, the methods differ. The ground must first of all be plowed, and furrows are then made in which entire canes are stretched *a chorros*, that is to say, end to end horizontally. The plants are then covered with earth. The sugar cane is frequently planted in the spring, but many planters are of opinion that plantations in Cuba sown in winter give a much better yield. The young plants are allowed to shoot for ten or eleven months if they have been planted in the spring, for fourteen or sixteen months if planted in the winter, and the harvest then takes place. There are in the island several varieties of sugar cane—the white or Otaheite cane, the twisted white cane, the twisted violet cane, and the so-called black cane.

The first two varieties are the only ones cultivated at Cuba. The white cane is prepared for planting in virgin soil, and gives a good yield. The crystalline is reserved for old plantations, it is better adapted to resist the long drought than the white variety. The cultivation of the last three species of sugar canes has been abandoned on account of their insufficient yield. Before the abolition of slavery, the planters themselves culvated their fields. Since that period, however, they have experienced the greatest difficulty in obtaining a sufficient number of hands to harvest their canes. Many planters, in consequence, deemed it advisable to divide their labor between a certain number of colonists, who are bound to cultivate each his plot of ground, to plant the canes, to cut them at harvest time, and to carry them to the factory, where they receive, after the sugar is turned out, a certain proportion of the quantity of the sugar extracted from the canes harvested on their allotments. Cuban sugar is generally prepared for export. The special quality intended for home consumption is clearer and finer than that shipped abroad.

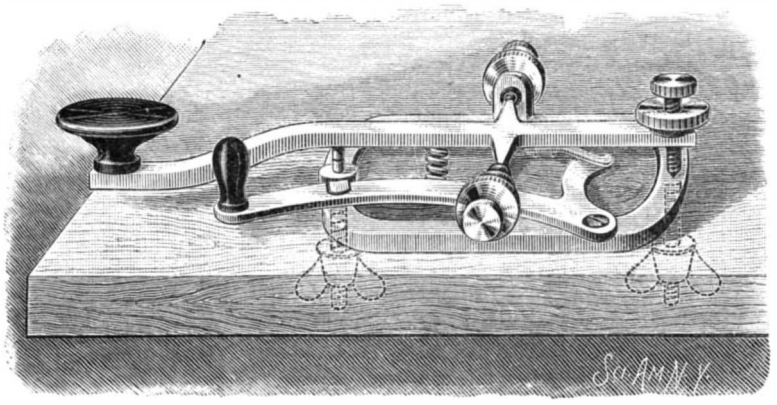
An Artificial Retina.

An artificial retina sensitive to light in the same way as the average human eye is certainly a great desideratum in photometry; and, according to M. Lion, this may be obtained by the use of a moist film of iodide of nitrogen. A new photometer is based on the employment of this substance. Since the longer the film is subjected to the action of the light rays the greater is the quantity of nitrogen disengaged, the sensibility of the instrument must continually increase with the time of exposure. This characteristic forms a decided advantage which the instrument possesses over others; but its significance is much diminished by the fact that it appears to take a considerable time before sufficient nitrogen is disengaged to take a reliable reading. In spite of the fact that the chemical action of light is caused chiefly by the non-luminous or ultra-violet rays, it appears that with this substance the luminous rays are most effective, and that, just as with the human eye, the yellow-green rays have the greatest influence. Considering the well-known fact that human eyes differ considerably among themselves, and that partly in consequence of this photometric measurements are subject to many errors, it would appear that the film of iodide of nitrogen can be regarded as an artificial retina, measuring illumination equally well, whatever its color. If a substance of this nature can be found which may be left to itself without danger, and from whose indications reliable readings may be obtained without the need of waiting some minutes, its applications to photometry would be numerous and important; and with this view it seems desirable that the action of light on complicated chemical compounds should be studied further than has hitherto been the case.—*The Electrician.*

IMPROVED TELEGRAPH KEY.

We give an engraving of an improved telegraph key recently patented by Mr. Wm. A. J. Kohrn, of 33 Franklin Street, San Francisco.

This improvement accomplishes two important results. First, the perfect closing of the circuit when the switch is turned; and second, the protection of the platinum points from the accumulation of dust and dirt. The improvement consists mainly in a spring attached to the under side of the rear end of the key, and a beveled arm projecting from the switch inwardly toward the center of the key frame in position to engage the spring as the switch is closed, thus forcing upward the rear end of the key, and causing the contact point carried by the key lever to touch the anvil contact, and to hold the parts in this position until the switch is again opened, when the usual retractile spring attached to the key opens the circuit. Besides closing the circuit through the contact points, it also closes the circuit by the contact of the switch with the anvil tongue.



KOHRN'S TELEGRAPH KEY.

It will thus be seen that there are two chances of securing a good closure of the circuit, one through the usual switch contact, the other through the points of the key. It will also be seen that as the platinum points of the key are held in contact so long as the key is closed, no dust can enter, and the surfaces will remain clean.

On the Fighting Instinct.

The student of nature is generally, if not universally, supposed to be the very incarnation of peace, and a well-developed organ of combativeness is considered decidedly out of place in happy Arcadie.

Nevertheless, the earth is one vast battle ground where all things living struggle for "the survival of the fittest"—that great and inexorable law, from the influence of which even the proud race of man is not exempt. Among the beasts of the field the law of force prevails. The finest specimens of each class survive, and the weaker go to the wall, or, perchance, the stomachs of their stronger brethren.

I think the Rev. J. G. Wood was the first to draw attention to the extraordinary fighting capabilities of moles. These clumsy, and apparently almost blind, masses of fur and sinew can occasionally become fiends incarnate, veritable subterranean tigers; and with such energy do they attack each other that, utterly ignoring the presence of man, they will rough-and-tumble at his very feet, their enormously muscular little limbs working convulsively, and bones audibly cracking beneath the pressure of their jaws. No one who has not witnessed a tourney of this nature would credit the extraordinary activity and fury which are here displayed, for, unless they are forcibly parted, the battle seldom leaves both combatants in the land of the living.

Hedgehogs are occasionally cannibalistic, the larger ones, when hard up for a dinner, chasing the smaller at a wonderful rate, and devouring them, without sauce or mercy, when caught and conquered. Curiously enough, the vanquished animal seldom employs against its own species its strongest means of defense—rolling itself up into the well known ball form.

A fight between two hares is a droll sight, appearing much like a jumping match, the skipping exercise being kept up with tremendous energy and spirit: but a blow from the leg of a hare is no laughing matter for the recipient, who occasionally finds himself knocked out of the world altogether.

The representatives of the order *Mustellidæ* are hard fighters, for a friend of mine once witnessed a duel between an old gray rat and a weasel, which lasted nearly an hour, and resulted in the annihilation of the former. The rat fought with great pluck and determination, but his antagonist was too much for him, and drew blood at every bite; while the rat, which displayed the utmost activity, rushing on again and again, failed to make much impression on the tough hide of the weasel. The latter fought in a very undemonstrative manner, appearing to act mostly upon the defensive; but his sharp teeth played havoc with the firm body of the rat, which finally retreated into a bundle of fagots, followed by the weasel. A great deal of scuffling and squeaking ensued, after which the rat was driven out into the open and there killed.

Among the *Gallinaceæ*, the pheasant may be considered "cock of the roost," for he will boldly enter the farm yard and settle the military-looking barn-door fowl in a trice.

Perhaps none, among smaller birds, wage war more desperately than the domesticated robin. It is said that he is guilty of parricide, the young ones chasing and slaying the parent before twelve months have passed over their youthful heads. Their first plumage is brown, but afterward red—perhaps a Cain mark, to distinguish them for their evil deeds. They follow up their battles with great pertinacity, and so frantic and lost to all sense of outer danger do they become, that, on two occasions, I have picked them up and held them in my hand, where they lay panting, but still holding on to each other with bills and talons. Once, two of these tiny gladiators fell from a tree under which I was discussing the good fare of a picnic, and, utterly ignoring the situation, finished the argument in my lap.

An invalid friend of mine, who is a close observer of nature, has a recollection of two cats, which advanced daily from opposite ends of a long and lofty wall, and, meeting in the middle, fought with great fury, until one or both were precipitated to the ground below, upon which the fight ceased immediately, the combatants remounting the wall, and basking peacefully side by side in the sunshine.

On one occasion, lately, a particularly fine Newfoundland dog was sitting on a wooden bridge discussing a bone, when a predatory mastiff came along, and, being unable or unwilling to distinguish between *meum* and *tuum*, a smart altercation arose. So violent became the debate, that both suddenly overbalanced and fell into the stream beneath. The nearest landing place was a hundred yards down, and to it the Newfoundland betook himself without much difficulty, and, after a good shake, was preparing to depart, when he suddenly became aware that the other dog, who was more of a soldier than a sailor, was wildly beating the water and drowning as fast as he could drown. One look was enough. In went he of the shaggy coat, and, seizing the other dog by the collar, brought his late enemy safely to land. The two dogs then eyed each other with a perfectly indescribable expression for some seconds, then silently and solemnly wagged their caudal appendages, and with dignity departed.

Some will, no doubt, say this was but instinct, and they may be right; but I prefer to give my four-footed friend the benefit of the doubt.—*J. A. Bartlett, in Longman's Magazine, London, September.*

Read before Signing.

Among the pithy sayings of a well-known German philosopher and reader occurs the following: "Sign no paper without reading it." In these days of education, enlightenment, and progress, such a caution would hardly seem necessary to any person in the full possession of his faculties; yet it is astonishing how many people there are, including good business men, who attach their signatures to papers or documents whose contents may have a serious bearing upon themselves or their affairs, with scarcely a glance at their contents. Carelessness in failing to acquaint themselves with the contents of a paper before signing it has worked incalculable harm to thousands of well intentioned people. It is a good thing, therefore, to bear in mind continuously the above quotation, particularly with respect to such papers as express or imply anything in the nature of a contract or a legal obligation.—*Trader Review.*

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The Greatest of Telescopes.

The news of the recent arrival from Paris of one of the lenses for the object glass of the 40-inch telescope that is to be made by the Clarks, of Cambridgeport, for the University of Southern California, has attracted considerable attention. It does not appear to be generally understood that the work of constructing the huge object glass that is to eclipse the Lick telescope has but just begun, and that the most difficult and delicate part of it has not yet been touched. Not one lens only, but a second, must be finished before the object glass is ready. That portion of a telescope consists of two lenses, one of flint and the other of crown glass, which by their different refractive properties correct one another's chromatic errors and produce an image free from confusing fringes of colored light. For two or three years the makers will slowly shape and polish the lenses, until every ray of light that passes through them is brought, as near as human skill can compass it, to one exactly accordant focus. When the glass is finished, only some of the rarest of the world's great gems will rival it in money value.

But the most interesting questions connected with the making of this huge telescope are: What will it be able to do? how much will its powers exceed those of the greatest telescopes now in existence? and what discoveries in the heavens may be expected from it?

The most powerful telescope now on our planet is that of the Lick Observatory, whose object glass is 36 inches in diameter. The celebrated telescope of Lord Rosse, in Ireland, is much larger, it is true, being no less than 6 feet, or 72 inches, in diameter, but that is an instrument of a totally different kind, being a reflecting and not a refracting telescope. In a reflecting telescope there is no object glass, but the image of the object looked at is formed by a concave mirror, which brings the rays of light to a focus by reflection. Lord Rosse's telescope, owing to the vast size of its mirror, receives far more light from a star than the Lick glass does, but the lack of complete reflection from the mirror and the imperfections in the mirror's form more than counterbalance this advantage, so that for most of the purposes of astronomy California's Lick refractor is a far more effective instrument than its giant reflecting rival in Ireland.

So it is with the Lick telescope that the new 40-inch glass should be compared. It is easy to compare the light-gathering powers of the two object glasses, since these vary directly as the squares of the diameters of the glasses. The square of 36 is 1,296, and the square of 40 is 1,600. It appears, then, that while the diameter of the new glass will be only one-ninth greater than that of the Lick glass, its light-grasping power will be about one-fourth greater. This will be a very important gain, if the workmanship upon the new glass is equal to that displayed by the old one, for celestial phenomena, such as faint stars and nebulæ, that lie beyond the reach of the great telescope on Mount Hamilton, will be readily seen with the aid of its larger rival in Southern California.

Among the discoveries which Dr. Holden has achieved with the Lick telescope is that of the existence of heliacal nebulæ, that is to say, of nebulous masses which, by some wonderful process, have been drawn out into vast spiral coils like the thread of a screw. These are not insignificant, but so extensive that if our own huge solid globe were expanded into a cloud of thinnest vapor, it would be but a speck beside them. The new 40-inch telescope ought to throw a flood of light upon these strange forms.

Then in astronomical photography, which has made astonishing strides within a few years past, the new telescope may fairly be expected to perform wonders. Its great object glass will grasp forty thousand times as much light as can enter the pupil of an average human eye, and this light, concentrated upon the extremely sensitive plates which the modern art of photography furnishes, will picture there scenes in the depths of space which no eye has ever beheld or could ever hope to behold in any other way. A marvelous field for research of this description has, within a few months, been discovered in the constellation of Orion, where many square degrees of the sky surrounding the Belt of Orion have been found to be covered with a network of nebulous streaks and patches, amid which shine thousands of stars. How this wonderful region will appear in the new telescope when it has been mounted on its mountain top in the transparent air of Southern California can, as yet, only be imagined.

A popular way of estimating the power of a telescope is by stating how near it will bring the moon. We observe that somebody says the 40-inch glass will make the moon appear only 100 miles away. This, when made without qualification and explanation, is a misleading statement. The apparent distance of the moon, or any other object, depends upon the magnifying power employed. An ordinary opera glass magnifies three diameters, and apparently brings all objects seen through it three times as near as they actually are to the observer. There are not a few telescopes now in existence that are capable of bringing the moon within an apparent distance of only 100 miles. For that purpose it is only necessary to use a magnifying power of 2,400 diameters, the actual distance of the moon being in round numbers 240,000 miles. This effect does not depend upon the size of the object glass, although the clearness of the view does. For telescopes of the best quality a magnifying power of 100 diameters for each inch of the diameter of the object glass may be used upon the moon with fairly good effect when the atmosphere is at its very best. By pressing the magnifying power beyond that degree more is loss by the increasing indistinctness and imperfection of the image than is gained by its greater size. Accordingly 100 diameters to the inch may be regarded as the upper limit of magnifying power for a telescope. A 4-inch glass should bear a magnifying power of 400 for bright objects when the atmospheric conditions are suitable. But usually so high a power is found impracticable, owing to the unsteadiness of the air and other causes, and a power of 60 to the inch is, perhaps, about the estimate of the best average capacity of an ordinary object glass.

With a very large object glass even this power is generally too great to produce a satisfactory image, so that about 50 to the inch may be regarded as the ordinary limit for a glass 40 inches in diameter. That would mean a magnifying power of 2,000 diameters in the case of this great new instrument, which would bring the moon within an apparent distance of 120 miles. With a power of 60 to the inch the moon's apparent distance would be just 100 miles, and supposing that the full power of 100 to the inch could ever be borne with good effect, which is highly improbable, the moon would appear only 60 miles away. Its features would not, however, be seen as distinctly as if it were actually at that distance from the eye, for the unsteadiness of the atmosphere and the imperfections of the image, even under the best of conditions, would impart considerable indistinctness to the view. Those who from mountain tops have seen objects of the landscape 60 miles away can accordingly form a more or less vivid idea of the sort of view of the moon's surface that the new telescope would be able to give at the limit of its powers.

But with a much smaller magnifying power—say 1,000 diameters, which would bring the moon within an apparent distance of 240 miles—far more distinct views of the lunar landscapes could be obtained. Under the very finest conditions for seeing, such a power might just suffice to reveal a steamship of the size of our largest transatlantic liners traversing a lunar ocean, especially if it emitted a cloud of black smoke. But then we must remember that astronomers are thoroughly convinced that the moon has no oceans, but at the best only dried-up ocean beds. A building as large as some of our huge exhibition halls could be seen as a minute speck. The existence of a large city on the moon would readily be detected by the 40-inch telescope. In fact, if there were any cities there, they would have been discovered long ago with the telescopes already in existence.

A great deal of light may be thrown upon some of the vexed questions concerning Mars, Venus, and the other planets by the new telescope. There are very puzzling appearances on their surfaces, some of which seem to demand for their solution but a comparatively slight increase of telescopic power beyond our present limit.

But as to inhabitants of other planets, the 40-inch lens will leave us as much in the dark, so far as the possibility of seeing them or their architectural monuments is concerned, as we have ever been. For any such achievement as that we shall have to wait until a genius comes who can invent an instrument for seeing as much superior to the present telescope as an arc light is brighter than a tallow dip.—*New York Sun.*

Aerial Navigation.

In a recent number of the *Forum* Prof. R. H. Thurston, director of the schools of mechanical engineering of Cornell University, discusses in an entertaining way the "Problem of Air Navigation." After reviewing many interesting experiments in aeronautics, Prof. Thurston thus speaks of the probability of the ultimate solution of the problem:

"The researches of Langley have shown the power demanded for flight to be about 2 per cent of the amount once supposed a minimum. We know that nature's energy can be directly converted into useful power through the production of electricity, as in the gymnotus, and possibly in all animal mechanisms. We know that modern storage batteries are ten times the weight that science indicates to be the limit of perfect efficiency; both steam engines and electric accumulators have been made light enough and powerful enough to raise their own weight, with something to spare.

The flying lemur, the flying squirrel, the rude sustaining membranes that inventors have constructed, have sustained their heavy weights in drifting many yards. Man has imitated such animals. His predecessors, the bats and the great pterodactyls, have flown on membranes. Why may not he hope some time to combine the highest products of his inventive genius in some contrivance which shall enable him to drive his fusiform balloon a hundred miles an hour, defying wind and storm; or why not hope to learn from the albatross and the condor and the eagle the secrets of flight, and, like them, to soar aloft and above the clouds, to glide hour after hour on widespread, motionless wings with the speed of gales that vex the earth below, and as far as the wild goose or the carrier pigeon or the migratory eagle can fly, crossing continents and oceans, as certainly and even possibly as safely as do railway trains or steamships to-day? It would be rash as yet to assert that all this is even possible; but it would be still more rash to assert the contrary. Man has accomplished hardly less wonderful tasks. Who shall say that the limit of his powers of invention and construction has been reached or even approached? The engineer, like the man of science, has an infinity of opportunity still before him. And it is to the combination of scientific knowledge and constructive talent of the engineer rather than to the haphazard operations of the hand and brain of the ignorant contriver of olden time that we are to trust, if at all, for the accomplishment of this, the most stupendous of his tasks. Scientific research, exact computation, precise adjustment of means to well understood conditions, are the lines which lead to final success."

Precious Stones of Commerce.

Geology has been a revelation to mankind, and has told us wonderful things of the past history of the earth; but geology has secrets of its own that are as hidden from comprehension as the atmosphere of the moon or the belts of Saturn. Certain things have been done, says the geologist, through volcanic action or the agency of fire, and that is as near as he can come to it; so that, after all, we see effects, but know little or nothing of causes.

There is a rock known as amygdaloid, one of the igneous rocks, which in some of the gigantic transformations of nature, we will say in cooling from a melted state, formed within itself cavities, from the size of a marble or bead to that of the closed hand. Now, as nature abhors a vacuum, she sets to work to fill these cavities, and in doing so she used other materials, and these combinations produced some of what we call the "precious stones of commerce." Exactly how this was done we cannot tell, but we see some hint of the operation in every subterranean cave where stalactites and stalagmites are found. Every student knows that this is the result of dropping water which contains carbonate of lime. The water evaporating leaves a minute particle of lime, which takes something to itself from the earth or atmosphere, and in the course of ages bodies are formed of a most remarkable character. In probably somewhat the same fashion have these cavities been filled in the igneous rocks, and then comes time and storm, and other agencies, earthquakes, perhaps, and the rocks are rent apart, and out drops a bead or a bowlder, and a curious man picks it up, and hammers and breaks it, and then he puts a polish on it by some process more or less advanced, and lo! he holds in his hand an agate or an onyx. Many of the stones used in the arts have no other origin, and are deposits of silica, alumina, oxide of iron, and other coloring substances.

It is the color or arrangement of colors that gives the name, and thus we have agate, onyx, chalcedony, carnelian, sard, chrystaloprase, sardonyx, and others, all members of the quartz family, and all having a family resemblance.

The agate has veins of different shades of color in parallel lines. Sometimes these are very close together, as many as fifty to the inch, but this is unusual. When there are alternate bands of color and a transparent medium we have the onyx, but the latter may be obtained by cutting the stone in a different way.

Agates are used chiefly for ornamental purposes, such as cups, seals, rings, handles for parasols, table and mantel ornaments, but the material is so hard that it can only be worked by those who have practiced skill.

The onyx was valued by the ancients for its application to cameos and intaglios—the first an object in relief, the latter a "cut-in" process; and these objects are still made.

Nature produces some very strange forms occasionally, and agates are found with exact resemblances of moss and other natural objects and figures, which are very curious and often very valuable.—*The Great Divide.*

A Substitute for Tobacco.

Many different vegetable substances used as stimulating beverages in widely distant parts of the world have been shown to contain caffeine as their active principle. Only one substitute for tobacco has, however, as yet been discovered. This is the leaves of the *Duboisia hopwoodii*, a shrub growing in Australia, the leaves of which are chewed by the blacks in the same way and for the same purpose as tobacco is chewed. The leaves contain an alkaloid, piturine, which is said by certain chemists to be identical with nicotine, but more probably is only closely allied to it. Messrs. Langley and Dickinson have recently shown that the actions of nicotine and piturine are in every respect identical.—*British Medical Journal.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

Mr. J. M. Isenberg, of Mines, Pa., has patented a gripping device for cars for inclined railways, which is designed to grip the rails the moment the speed of the car exceeds a certain limit. This improvement can be applied to any car body or truck. It consists in a centrifugal governor operated by one of the car axles, and a grip which is set in operation by the governor as the limit of speed is reached.

Mechanical.

Mr. R. Baumann, of St. Louis, Mo., has patented a combination lock and electric alarm, which is adapted for doors, money drawers, etc. This is an ingenious union of a combination lock with a door latch and lock, and an electric device for giving an alarm whenever the door latch or lock is operated. The electric device is detachable, so that when desired the lock can be operated by authorized persons without giving an alarm.

Mr. Wm. J. Wright, of Cooperstown, Pa., has patented a stave trimming, jointing and planing machine, in which the billet is first trimmed in sizes to suit the character of the material, after which the billet is automatically fed into the machine through the various stages necessary to complete the stave, and as it progresses automatically controls and sets the cutting devices so as to cut both the bevel and form the bilge of the stave in exact proportions relative to the different widths of the billet.

Mr. M. A Libbey, of South Berwick, Me., has patented an improved mechanism for propelling vehicles. This invention includes novel mechanism for applying the power to the axles of the vehicle, and for guiding it.

Mr. R. W. Welch, of Lexington, Neb., has patented a brake for baby carriages, for preventing the movement of the carriage whenever it is desirable that it should remain stationary. The brake consists of a clip attached to the carriage axle and a finger pivoted in the clip and adapted to fold down between the spokes of one of the wheels.

An improvement in shackle clawbars for drawing spikes and analogous uses has been patented by Mr. John H. Morgan, of Lebanon, Ind. The clawbar has a two-armed hook pivoted to it which is adapted to engage the head of a rail. The hook is capable of being swung around the neck of the clawbar, thus making the implement reversible.

Mr. J. L. Strahl, of Gloucester, Ohio, has patented an improved gauge for woodworking machines. This gauge is adapted for grooving, gaining, crosscut sawing, mitering, etc. It consists of a slide mounted in a suitable guide on the saw table or other woodworking machine, and provided with a graduated plate pivoted to the top of the slide.

Mr. J. Kirwan of Asbury Park, New Jersey, has patented an improved leather skiver. This machine is designed for skiving the edges of soles, or thinning welts to an even thickness throughout. This is a hand tool, which is adjusted before use so as to make a shaving of the desired thickness according to the leather to be operated upon. The tool is drawn around the sole, trimming the edge and at the same time thinning it, leaving the middle portion of the sole of the ordinary thickness. The depth of the cut made by the tool is regulated by an adjustable gauge.

A dust collector for grinding machines has been patented by Messrs. E. King & H. Geisenhoner, of Schenectady, N. Y. This device may be adapted to grinding machines of various kinds. It consists of an endless belt running over rollers, and carried in close proximity to the periphery of the emery wheel, the tool being arranged to receive motion from the shaft of the emery wheel, and in its travel is made to pass through a body of water, thus keeping it constantly mosit, so that the particles thrown off in the operation of grinding become attached to the endless belt. These particles are washed off in their passage through the water.

Mr. A. B. Bonneville, of Allentown, Pa., has patented an improved conveyer designed for moving material that has been operated upon by a rotating calcining cylinder. The main difficulty heretofore experienced in conveyers for this purpose has been the melting of portions of the conveyer by the intense heat of the products of the furnace. This invention has obviated this difficulty by creating a draught of air through the conveyer tunnel, thereby not only cooling the calcined material, but preventing injury to the conveyer.

Mr. J. T. Turner, Sing Sing, N. Y., has patented an improved cotton gin saw, which consists of a disk, and a band of ribbon of greater width than the disk provided with teeth on opposite edges and secured to the periphery of the disk. By means of this construction the material is economized and the manufacture of the saw is simplified and cheapened.

Electrical.

Mr. F. Milliken, of New York City, has patented a metallic post. This post consists of longitudinal flanged segments connected at their flanged edges with rivets, bolts or studs, which form the ties between the two longitudinal portions, and also serve as rungs when it becomes necessary to climb the post.

An improved rheostat designed for use in connection with medical batteries, but equally well adapted to other purposes within the range of the instrument, has been patented by Mr. J. C. Vetter, of New York City. This invention consists in an extensible and compressible cell provided with insulating sides and a conducting top and bottom, a screw for moving the top toward or from the bottom, and a powdered conductor or semi-conductor contained in the cell and adapted to be compressed so as to increase its conductivity, or released so as to increase its resistance, according to the requirements of the case.

Dr. R. L. Watkins, of New York City, has patented a device by means of which the position of a piece of metal in the body, such for example as a bullet, may be accurately located, and which is also used for testing the electric circuits. It consists mainly of a probe formed of two semi-cylindrical parallel bars connected by insulated rivets, and arranged to form a smooth needle. The two parts of the needle form the terminals of an electric circuit, which is completed through flexible coils and zinc and copper plates applied to the tongue. The zinc and copper plates, together with the fluids of the mouth, form a battery, so that when the circuit is closed on the metal touched by the probe, the effect of the current will be perceived by the tongue.

Agricultural.

Mr. K. Buland, of Linn Grove, Iowa, has patented an improved cotton planter, in which the runners may be readily adjusted vertically, and which may be used without the necessity of employing a marker. Means are provided whereby the depth of the furrow may be regulated at will.

Mr. F. C. Kriz, of Milwaukee, Wis., has patented an improved pitchfork, in which the fork is pivotally attached to the handle and supported in the position of use by a spring, the fork handle being furnished with stops which limit the movement of the fork.

Miscellaneous.

A novel liniment pad provided with detachable fastening tabs for securing it to the body, thus adapting the pad to be removed and recharged with liniment, has been patented by Mr. B. T. Jacobs, of Stapleton, N. Y.

An improved necktie fastener has been patented by Mr. M. N. Bailey, of New York City. It is made of a piece of wire bent into peculiar form and adapted for attachment to any necktie. This fastener is designed to take the place of the ordinary needle fastener commonly applied to scarfs and neckties.

Mr. John L. Easley, of New York City, has patented a lemon squeezer, which is so constructed that all the released juices of the fruit will be conducted to the receiving vessel, while the pulp is prevented from passing into the vessel. The invention consists of a conical lemon receiver provided with a series of ribs of different length, a flanged base having a concave upper face, and an upper surface provided with a series of concentric grooves for receiving the tumbler in connection with which the squeezer is used.

An improvement in the rigging of vessels has been patented by Mr. C. M. Hayden, of South Thomaston, Me. The object of this invention is to prevent the mast hoops from clinging to the mast when the sail is raised, and to cause all of the hoops to sustain an equal strain, thereby avoiding the danger of tearing the sail. The invention consists in connecting all the mast hoops together and with an attachment applied to the gaff bail.

SCIENTIFIC AMERICAN
BUILDING EDITION.

OCTOBER NUMBER.—(No. 60.)

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2525) F. G. S., Denver, asks: Will you kindly give a few more particulars in Notes and Queries concerning the tests on Portland cement for anchoring bolts? What you consider the proper relation between bolt and hole, and also the correct way to mix the cement? A. For strong work use Lewis or split head bolts and wedge. Make the hole from 8 to 10 times the diameter of the bolt, in depth, and just large enough to enter the bolt with the wedge just entered in the split end. Fill the hole with Portland cement, quickly mixed with water, nearly as stiff as putty. Drive the bolt home with a mallet. Bolts set in this manner in brick walls, laid in cement, have been broken in a test to pull them out by a pull on the nut. For anchorage or side pull bolts, upset ends driven as above are very strong as used for guys. Make upset ⅛ larger than bolt. For holding down machinery the split bolt only should be used.

(2526) G. W. H. asks: 1. Is coal oil a distillation from coal? A. Possibly and quite probably. 2. Or is coal solidified coal oil. A. No.

(2527) F. W. P. asks: Can you give a treatment for baldness and falling out of the hair, superior to the usual tincture cantharides mixtures? A. We refer you to the SCIENTIFIC AMERICAN, Vol. 62, No. 9, page 135, for a treatment for the hair. Also to our SUPPLEMENT, Nos. 161, 416, 173.

(2528) O. K. A. asks for a receipt for making a nickel or silver plating suitable for iron or steel. A. For silver and nickel plating we refer you to our SUPPLEMENT, No. 310, and many others. Iron or steel must have a light deposit of copper before plating with silver.

(2529) H. E. C. writes: I would like to know if there is or can be put something in kerosene oil lamps that will put the oil in such a condition that it can only be ignited at the wick, or that the lamp cannot explode, either liquid or dry state. A. There is no such substance. Materials for the purpose have been sold by unprincipled dealers through the country, but no faith should be placed in any of them.

(2530) S. P. R. writes for a receipt for a silica paint and a receipt for a fibrous and waterproof paint. A. Ground silica has been mixed with white lead, but it is to be regarded as an adulterant. Asbestos mixed with oil and body (white lead) is the best approach to the latter that we can give.

(2531) F. W. L. asks: Can you tell a way to clean a steel engraving that has been wet and badly soiled? A. Soak in weak solution of hypochlorite of soda (Javelle water). Start with it weak and strengthen if necessary.

(2532) W. D. G. asks why wood gas is not more used and for references to any literature, books or papers, where its manufacture and value are treated of. A. Wood gas costs more than coal gas. It needs considerable purification or treatment of some kind, owing to the large proportion of carbonic acid gas. It is treated of in the recent works on the manufacture of gas, but except for special cases is a dead issue.

(2533) J. B. asks if it is practicable in connection with artesian well boring operations to fish up pieces of iron from the bottom of the bore with an electro-magnet. If so please give dimensions, form of magnet, size of wire and winding. Also what form of battery to use? A. An electro-magnet could be used for this purpose. The best form of magnet for the purpose would be an iron tube closed at one end with an iron core extending from the center of the closed end to the open end of the tube, leaving an annular space for the winding. Use No. 14 wire, and a plunging bichromate battery with 6×8 inch zinc and carbon plates. 2. Would the magnet work if casing is in the bore and some water? A. Yes. 3. Would a permanent magnet answer as well? A. A permanent magnet might answer for small pieces. 4. Which is the stronger, malleable or common cast iron, and why? A. Malleable iron is much stronger than cast iron, being more of the nature of wrought iron or low steel. 5. Are malleable castings used in heavy machinery, and what weight is the heaviest of such castings you know of? A. Heavy malleable castings have been made. We cannot give weight. 6. Can you tell me what is the price of the phonograph, and could it be sent through the post? A. The phonograph is rented, not sold. It is too heavy for the mail. 7. Are there any books treating blacksmithing or forging? A. "Practical Blacksmithing," by M. T. Richardson. 3 vols. Price by mail complete $3. 8. What book would you recommend for a new beginner in electricity? A. "Experimental Science." See our advertising columns.

(2534) C. H. R. asks what to put into sirup made from sugar, to prevent crystallization. A. Make your sirup from 35 parts water and 65 parts sugar and keep in a smooth surface vessel. It will not crystallize.

NEW BOOKS AND PUBLICATIONS.

THE AMATEUR PHOTOGRAPHER'S HAND BOOK. A manual of instruction for the amateur. By Arthur Hope. 151 pages, cloth. Price $1.25. The John Wilkinson Company, publishers, Chicago, Ill.

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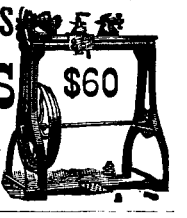

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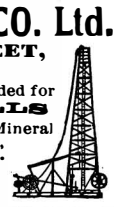

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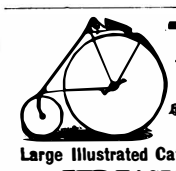

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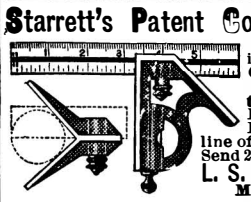

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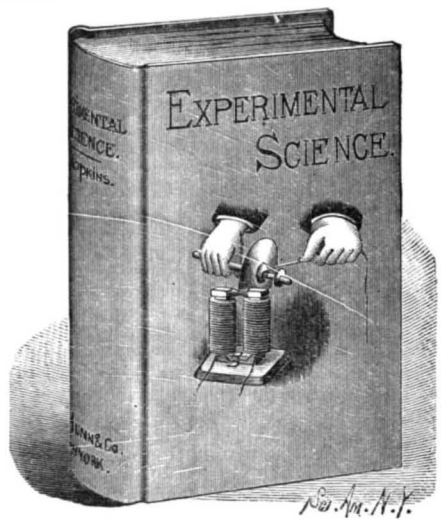

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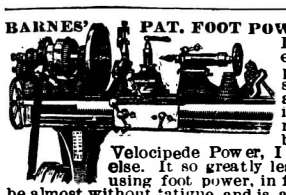

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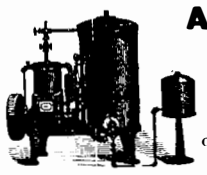

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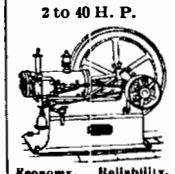

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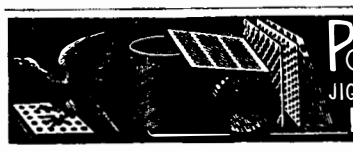

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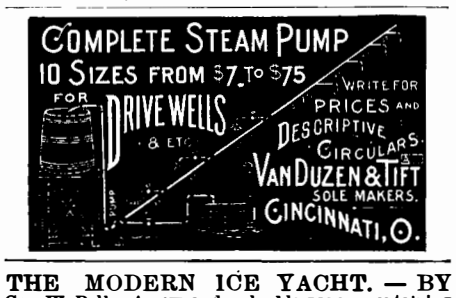

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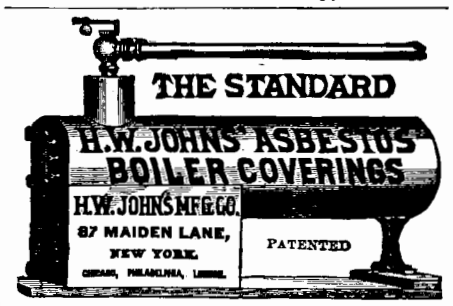

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